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Reliable Auxiliaries

Influence upon Efficiency and Costs

EXCEPT for the feed pump, the original function of power station auxiliaries was improvement of plant efficiency or labour saving, which implies improvement of human efficiency. As the fulfilment of these desirable ends cannot be allowed to reduce the high order of reliability of associated main generating units, it follows that each item of auxiliary equipment essential to moment-by-moment operation must be equally dependable. In the second place, the difference between kWh generated and sent out may be as much as 8 per cent; a wise selection of auxiliary drives in the initial design stages which takes into account the ultimate capacity of a station is likely, therefore, to influence economic performance appreciably throughout the life of the whole plant.

Risk of Over-Insurance

In guarding against excessive capital expenditure, or over-insurance, the separation of " non-urgent " auxiliaries (a more accurate description than " non-essential " for which it was substituted in the discussion on Mr. W. Szwander's I.E.E. paper last week) from the others and simplicity of layout both serve the purpose of increasing reliability as well as economy. Although power station interconnection through the grid has greatly reduced the chances of serious interruptions in service, there is the countervailing consideration that generating units are increasing in size and that the margin of reserve plant is less than in earlier days. Moreover, the influence of auxiliaries has been felt in recent cuts in supply, since a critical factor is the effect on the stability of certain auxiliaries of a drop in frequency of more than 4 per cent.

The importance of the subject most assuredly justifies Mr. Szwander's comprehensive and fair survey of the diverse factors that govern supplies to auxiliary systems in modern power stations. Quite clearly any attempts at close standardization would be premature by a long way, having regard to the diversity of operation conditions obtaining, including such matters as steam conditions and the kind of coal used and the method of firing.

All-Electric Drives Favoured

A pleasing feature of the discussion was the testimony afforded from experience of the reliability of all-electric drives. Even if, on economic grounds, a case can be made out for steam drives in some instances, any suggestion of the old idea that these afforded better security is likely to prejudice electrification of vital plant in factories and mines. To a less extent, similar considerations are in favour of transformers rather than house sets.

There was also the feeling expressed that automatic features should have as their object the aiding of the fireman to perform his duties more effectively and not to take the work out of his hands. As a general principle the use of a.c. motors commends itself but, for close speed control, d.c. is still unrivalled and its adoption in the boiler-house in conjunction with Ward-Leonard sets has some of the same arguments in its favour as it has in its increasing use for rolling mills and

colliery winders. Although much has been written on various aspects of auxiliary services in power stations, little has been done hitherto to integrate developments and present them in full perspective and the present paper is likely to remain for many years a definitive reference source.

Carmarthen Bay Station

MONMOUTHSHIRE'S loss is now Carmarthenshire's gain. The construction of a 300,000-kW station at Burry Point is to be started by the Llanelly Co. next year, but a good deal of preliminary work has been done in an effort to make up for delay in providing urgently needed plant capacity caused by objections raised to the erection of the Llanover station. Presumably works entailing a capital expenditure of £12 million to be spread over a long period (since only one-third of the station, costing £5 million, will be required within the next three years) will be a substantial asset to the neighbourhood.

Coal Restrictions

IN his latest statement on the power position Mr. Shinwell shifted the emphasis from plant to coal though the shortages of both remain equally serious. At last it has been decided to institute a form of rationing, but this will apply only to the larger industrial and commercial concerns; the impossibility of rationing the smaller consumer is still recognized and this class is appealed to for economies to prevent industrial dislocation and unemployment. Instead of curtailing coal supplies to power stations (and gasworks) the Minister intends to keep deliveries down to the present rates, a decision which may involve electricity supply undertakings in no little difficulty.

Brake on Prosperity

THE Central Electricity Board expects to have to resort to " load shedding " for the next three or four years and it is considered likely that with demands exceeding expectations the position next winter may be worse than it is now. To supplement the present 11½ million kW of generating plant (a good deal of which is obsolescent or needs repair) the provision of about 6 million kW of new plant has been approved for service by the end of 1950. Practically all programmes for new stations and extensions are, however, well behind schedule: only about one-half of the million kW of plant planned to be in commission this year will in fact be available. No blame can be attached to the C.E.B., the supply authorities concerned or the manufacturers. It is entirely due to shortage of materials and manpower. The only solution in sight is the granting of the highest " priority " to the production and installation of generating plant. Otherwise plans for expanding industry and raising the standard of living will prove fruitless.

Fluorescent Street Lamps

A SUFFICIENCY of properly directed lumens that is suitable for arterial road lighting does not necessarily best meet the needs of important urban shopping centres. Ability to discriminate closely between colours is an amenity that is worth paying for in some circumstances. The enterprise of Central London Electricity has opened up a new field for tubular fluorescent lamps (with their potentialities for further scientific development) and has provided opportunities of which lamp manufacturers have been quick to take full advantage. While the merits of this form of illumination in the experimental installations described on another page are obvious, the tests to be conducted this winter will no doubt suggest improvements in technique and economical application that should secure the widest public appreciation.

Raw Material Shortage

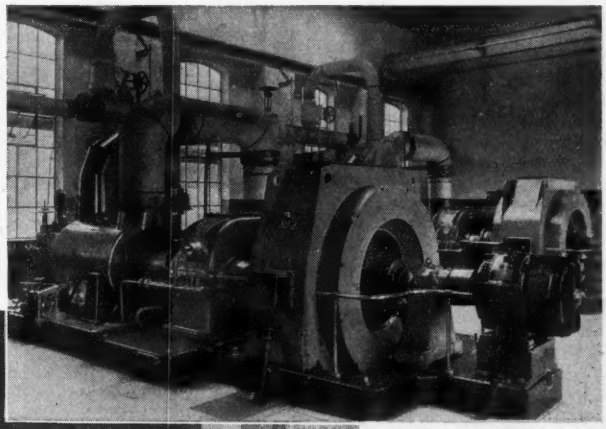
THERE is a tendency to regard the United States as almost self-sufficient in most raw materials, rubber being an outstanding exception, but according to Mr. W. Clayton, Under-Secretary of State for Economic Affairs, the war has made grave inroads into American resources causing " depletion or near depletion " in some cases. Consequently the United States Government intends to encourage American investments in " strategic " raw material resources in other parts of the world. Mr. Clayton mentioned, among other supplies, copper, tin, bauxite, chromium, manganese and high-grade iron ores. In many of these materials the shortage is not confined to the United States and the decision raises unpleasant prospects of increased competition for them.

Industrial Supply Scheme

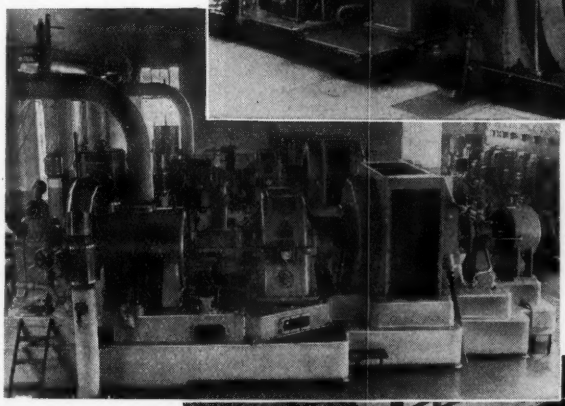
Large Scale Use of Process Steam Dictates Private Generation

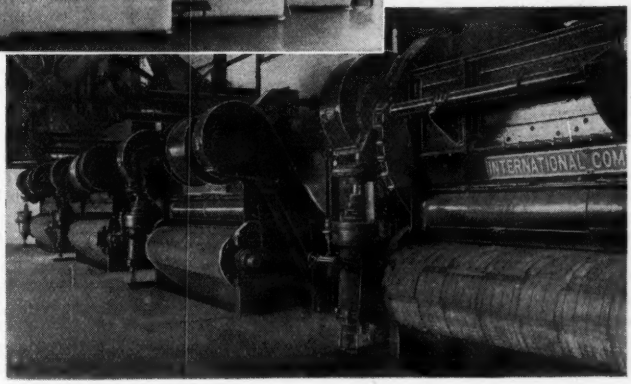
IN the *Electrical Review* of July 19th, August 23rd, October 4th and November 29th, we published accounts of the electrical applications to the various stages of the production of shale oil and additional products throughout the workings of Scottish Oils, Ltd. In the first article reference was made to the extensive work of modernization which has been going on for the past ten years in the various mines and works, of which the extensions and improvements to and conversions of the electrical installation form an important part. It is our intention in this article to describe the electrical generation and distribution system which has been evolved to serve the whole of the workings.

Throughout the 50 square miles covered by the activities of this company there are many points where considerable quantities of process steam are required, and this has been the main



The generating plant at Addiewell consists of two 1,000-kW turbo-alternator sets

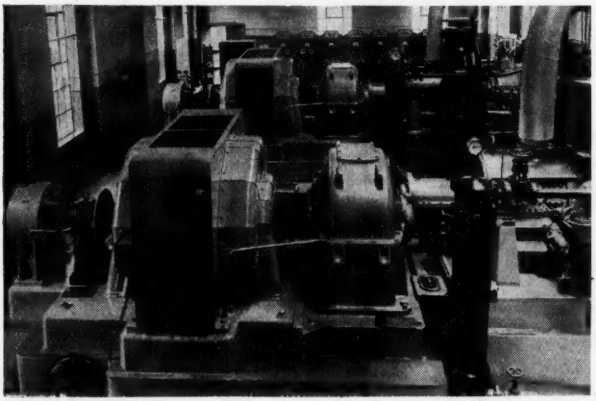




At Westwood four 30,000-lb per hr boilers (right), supply two 1,800-kW turbo-alternator sets (above)

influence behind the adoption of private generation. It is also the reason why a number of power stations are employed rather than central generation, because it is essential to generate steam locally at each crude-oil works. The modern practice at these works is to generate by modern turbine plant and to supply the retorts at about 3 lb per sq in. from the turbines' exhaust, and to employ steam for distillation purposes at about 15 lb per sq in., which is obtained by extraction from the turbines. Each turbine is equipped with an " Arca " steam-pressure regulator for regulating the supply of pass-out steam according to the demand.

In addition to the crude-oil works there is the central refinery at Pumpherston where low-pressure steam is also required for distillation and other purposes at 15 lb per sq in. only, so that in this case condensing plant is installed with the pass-out turbines. Of the six crude-oil works, five—Addiewell, Westwood, Deans, Roman Camp and Niddry Castle—are fully electrified, and in each of these cases there is a self-contained power station so that, with the station at Pumpherston, there are six generating stations in all.



Two 1,800-kW sets at Niddry Castle

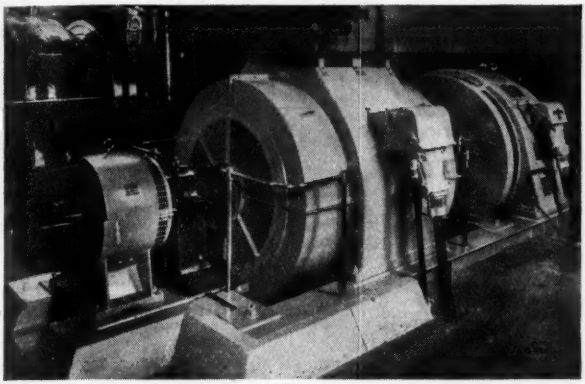
The plant capacity at each crude-oil works power station is decided by the electrical requirements at the works and the associated mines. It so happens that at present this arrangement fits in with the steam requirements at each works, the electrical and steam requirements being thereby reasonably balanced. There are times, however, when live steam has to be taken direct from the boiler plant for the process demands. The conditions at the Pumpherston refinery are rather different from those at the crude-oil works, inasmuch as the electrical loading and the process steam demands are not balanced, and live steam for process normally has to be taken direct from the boiler plant. At Addiewell the generating plant consists of two 1,000-kW Belliss & Morcom-Harland turbo-alternator sets generating at 3·3 kV, and the boiler plant consists of four 18,000 lb per hr John Thompson boilers with steam conditions of 200 lb per sq in. and 500 deg F.

At Westwood there are four 30,000-lb per hr Clarke Chapman boilers with steam conditions of 200 lb per sq in. and 500 deg F, supplying two 1,800-kW Belliss & Morcom-Bruce Peebles turbo-alternators generating at 3·3 kV. There are at the Deans power station three 500-kW sets with Howden compound steam engines driving Siemens alternators. These also generate at 3·3 kV. The engines are served by six 15,000-lb per hr Stirling type boilers which supply at 160 lb per sq in.

At Roman Camp there are four Belliss & Morcom compound steam engines driving Siemens alternators with a total plant capacity of 1,300 kW, generation at 3 kV. The steam supply comes from a total capacity of boiler plant of 93,000 lb per hr at 160 lb per sq in. At Niddry Castle there are two 1,800-kW Belliss & Morcom-Bruce Peebles turbo-alternators generating at 50 cycles, as well as two 500-kW Belliss & Morcom-Bruce Peebles sets generating at 25 cycles which are now used only as a stand-by to an 850-kW frequency changer which is normally supplied from the 50-cycle system. These are supplied at 200 lb per sq in. by three 30,000-lb per hr and two 15,000-lb per hr Stirling boilers. At Pumpherston there are two 1,000-kW B.T.H. turbo-alternators and a 1,500-kW Allen-Bruce Peebles turbo-alternator, generating 3·3 kV. Steam in this case is supplied at 160 lb per sq in. by seven boilers with a total capacity of 167,850 lb per hr.

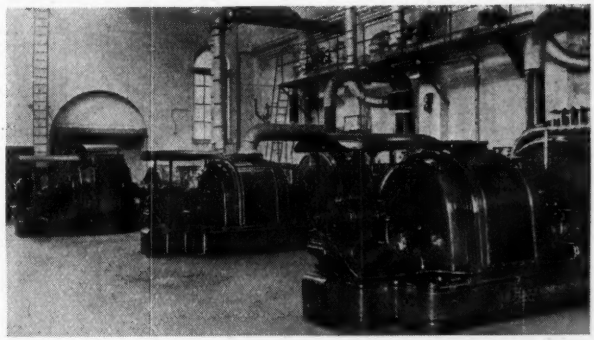
The Addiewell crude-oil works is in the N.W. corner of Midlothian, and all the crude-

oil works lie in a north-easterly direction from this and in West Lothian. Westwood is about two miles north-east of Addiewell, and Deans is three miles further north-east. Pumpherston is about 4½ miles almost due east of Deans, Roman Camp is about a mile north-east of Pumpherston, and Niddry Castle is about four miles north-east of Roman Camp. It will thus be seen that geographically the power stations lie in two areas, with three stations in each—Addiewell, Westwood and Deans to the west, and Pumpherston, Roman Camp and Niddry Castle to the east. This geographical division is the main reason why the distribution arrangements are divided into two separate systems.



The 850-kW frequency changer at Niddry Castle is supplied from the 50-cycle system

We will first describe the western area system of which Westwood is the focal centre. Here duplicate busbars are provided, while at Addiewell and Deans there are single busbars. By means of busbar section switches at the stations, however, the three power stations can feed to or through either of the busbars, by virtue of links between the stations. These links are for emergency purposes only, the normal method being to run each power station to supply its own local group of works and mines. Between Addiewell and Westwood there is a direct 3·3-kV underground cable. Between Westwood and Deans there is a 3·3-kV connection via the Breich Pit switchboard, Breich Pit being the normal source of shale for the Deans works. In addition to this indirect link between Deans and Westwood there is an underground connection between Breich Pit and Westwood via the Almond River pumps. To obviate the possibility of connecting any part of the system to more than one supply, special coils are fitted on the circuit-breakers feeding Westwood from Addiewell, Breich Pit from Westwood, Breich from Deans, and the two supply circuit-breakers at Breich Pit. The arrangement of these coils is such that when energized from one supply the circuit-breaker cannot be closed on the other supply. The pumps can be supplied with their power either way from Westwood, i.e., direct or via Breich Pit.

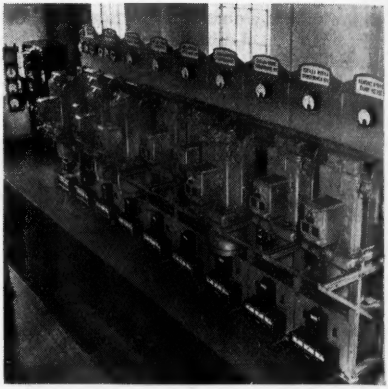


Two 1,000-kW and a 1,500-kW turbo-alternator sets at Pumpherston are served from a 167,850-lb per hr boiler installation

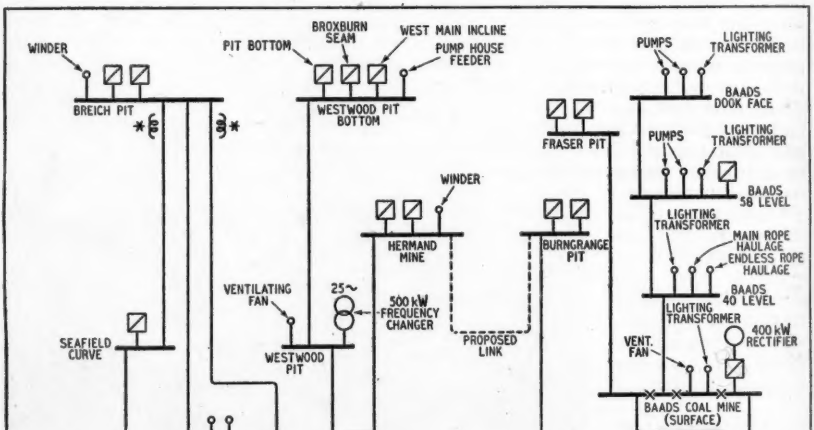
Addiewell switchboard is sectionalized by a busbar coupler from either side of which a feeder supplies Baads coal mine. This coupler is really intended to afford a supply to Addiewell, if necessary, but it also makes it possible

to supply direct to Baads from Westwood. There are also two couplers in the Baads switchboard, only one of which can be closed, thus ensuring that it is not possible to parallel the two stations while taking the two supplies. Fraser Pit is supplied by an extension from the Baads mine switchboard. The system at Baads mine is d.c., and the supply is therefore given by a 400-kW Bruce Peebles double glass-bulb rectifier. This installation is rapidly being changed over to a.c. 3-phase, 3·3 kV being taken right up to the coal face.

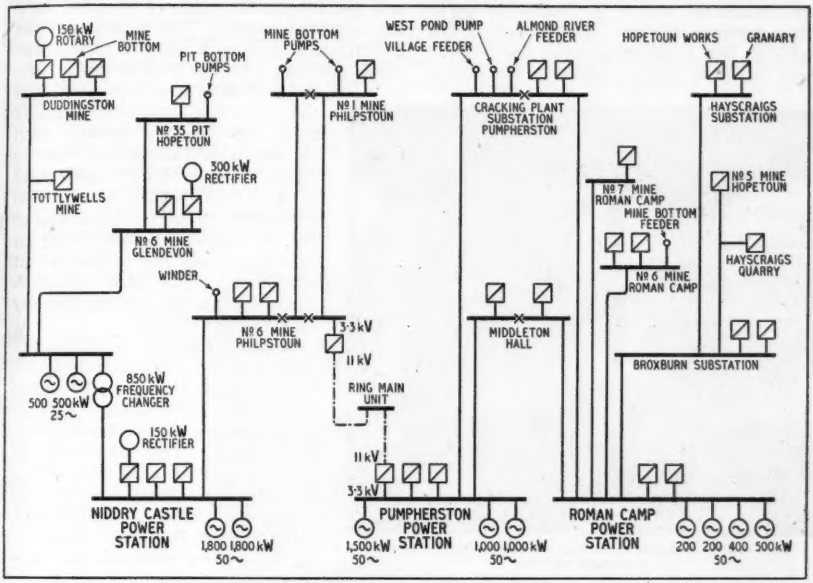
Apart from the interconnections, various pits are fed singly from the stations. For instance, Westwood pit is supplied from the 3·3-kV Westwood switchboard through a switchboard at the pit. The Westwood system is 25 cycles, and to meet this there is a 500 kW Crompton Parkinson frequency changer. The system is at the moment being changed to 50 cycles to bring it into line with the other systems. Burngrange is supplied from Addiewell direct at 3·3 kV. The Hermand mine is also fed from the Westwood switchboard at 3·3 kV. There is in prospect a scheme for a link between Hermand and Burngrange, so that an alternative supply to Burngrange can be provided from Westwood and vice versa.



By means of section switches on the h.v. board at Westwood the three power stations—Addiewell, Westwood and Deans—can be fed to or through either of the busbars via the station interlinks



The geographical division of the area in which the power stations lie is the main reason why the distribution is arranged in two separate systems. The western area is shown above. X = busbar section switches; ★ = circuit-breaker. Coils here prevent supplies from two sources

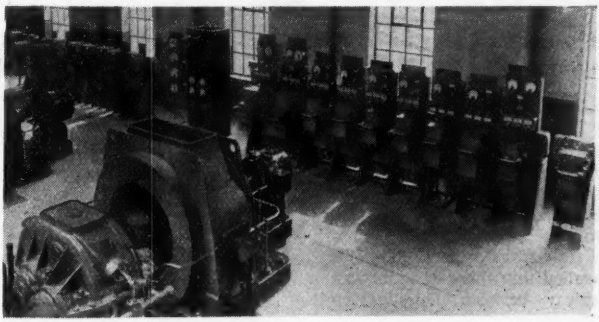


The eastern geographical division of the area

Referring now to the eastern area distribution system, the cracking plant at Pumpherston has a substation connected to both the Pumpherston and Roman Camp power stations, which makes two supplies available to the cracking plant. Placed between the two connecting units on the Pumpherston board, is a busbar coupler, and a "two-only-on-at-one-time" locking scheme covering these three units ensures that the Roman Camp and Pumpherston power stations cannot be run in parallel.

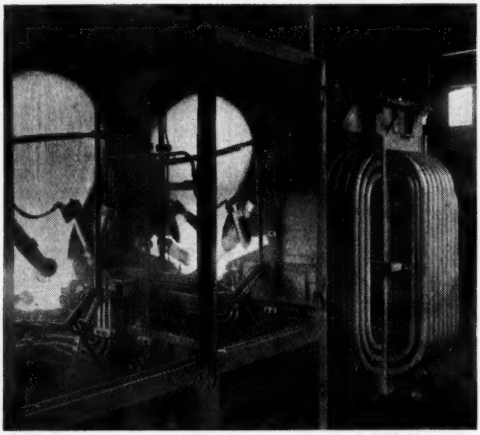
At Middleton Hall there is a substation for supplying the headquarters and various workshops. This substation is linked with both the Roman Camp and Pumpherston power stations, but here again a busbar coupler and a locking scheme prevent the two stations from being run in parallel. From the Roman Camp power station there are two simple direct feeders to the two substations of the Nos. 6 and 7 Roman Camp mines. In both cases step-down takes place at the surface, and the underground is supplied at 440 V.

A further group of supplies from Roman Camp is taken via a substation at Broxburn by a single 3·3-kV cable. In addition to providing supplies to the candle factory and acid works at Broxburn, extensions from the Broxburn switchgear provide in one case a service at 3·3 kV to No. 5 Hopetoun mine,



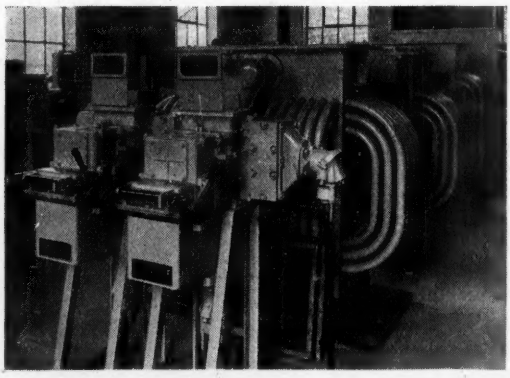
Between Addiewell and Westwood there is a direct 3·3-kV link; Addiewell h.v. switchgear (right) l.v. switchgear (left)

and in another case to the Hopetoun works via a distribution centre at Hayscraigs. The cable to No. 5 Hopetoun mine has recently been tapped to afford a supply to Hayscraigs quarry where shale is being obtained by the open-cast method. It is anticipated that in the near future the No. 5 Hopetoun mine will be closed down, as the seams are nearly worked out, and then the cable will be cut at the tee point, leaving, in effect, a direct 3·3-kV line to the quarry. The mines at Tottlywells and Duddingston each have a 25-cycle system, and substations at these two mines are therefore fed from the 25-cycle board at Niddry Castle power station, there being a direct 3·3-kV, 25-cycle connection to Duddingston with a tee-off to Tottlywells. Two other 25-cycle supplies are taken from Niddry Castle by a single main to No. 6 mine, Glendevon, and to Hopetoun No. 35 pit, the Hopetoun pit supply being provided by an extension from the Glendevon substation. The system at Glendevon is d.c. underground, and this is served by a Bruce Peebles double glass-bulb rectifier of 300 kW, supplied from the switchboard through a suitable transformer. It will be recalled that there is an electric railway between Duddingston and Niddry Castle which is operated on a d.c. overhead system. This is served at the Duddingston end by a 250-kW rotary convertor supplied from the 25-cycle system, and by a 150-kW glass-bulb rectifier at the Niddry Castle end, supplied from the 50-cycle system, each via a suitable transformer. On the 50-cycle side at Niddry Castle there is a 3·3-kV feeder to the two Philpstoun mines, the substation at No. 1 Philpstoun mine being an extension from the substation at No. 6 Philpstoun mine—which is directly connected to the Niddry Castle power station.



D.C. supply to Baads mine is afforded by a 400-kW double glass-bulb rectifier

Between the No. 6 Philpstoun mine and the Pumpherston power station there is an 11-kV interconnector, the main object of which is to give the Philpstoun mines a dual supply. This interconnector is connected at each end to the 3·3-kV board through step-up and step-down 1,200-kVA transformers. Incidental to this main duplicate supply scheme provision has been made for possible further connections to Broxburn and Glendevon from this 11-kV main, the cable route being chosen with an eye on this possible development. If and when required the cable can be looped into the Broxburn substation, and by means of a ring-main switch unit it can be developed for a supply to Glendevon. From each of the 3·3-kV switchboards mentioned in connection



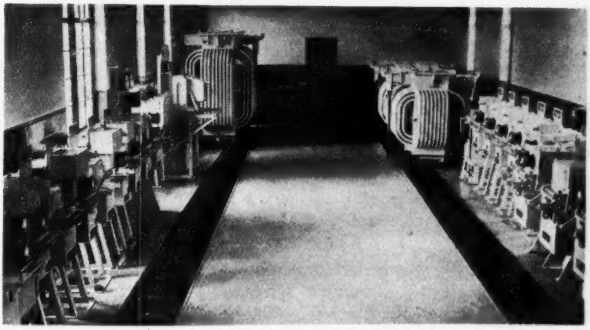
At Niddry Castle the electric railway is supplied from the 50-cycle system by a rectifier through a suitable transformer; normal supply and rectifier transformers, and neutral switches in foreground

with both the western and eastern area distribution systems, one or more 3·3-kV/440-V transformers are supplied for the works or mine low-voltage supplies. In each case there is a further step-down from 440 to 110 V for lighting supplies.

The switchgear throughout the system is now almost entirely modern compound-filled Metrovick equipment. The alternators are protected by the combined overcurrent and earth leakage system, with time-current relays working on the core balance principle for external faults. For internal protection of the alternators the system is restricted earth leakage, with instantaneous relays. High-voltage main feeders have the combined overcurrent and core balance earth-leakage system of protection with time-current relays.

Generally the low-voltage main feeders are provided with combined overcurrent and earth-leakage protection. All the alternator neutrals are earthed through suitable resistances in connection with this protection, and the low-voltage neutrals of the transformers are solidly earthed. In some cases, such as the Baads coal mine and the Westwood pit, high-voltage cables are extended from the main surface substations to secondary substations underground from which the low-voltage distribution is effected.

Taking the Westwood works as a typical example of the modern low-voltage distribution, the system is by double feeders to the larger plant units and by single feeders to the smaller units, linked to form ring mains. Suitable isolators are provided on the plant switchboards to provide the necessary sectionalization of this ring-main system. Most of the modern low-voltage switchgear is of the compound-filled Metrovick type.



Between No. 6 Philpstoun mine and the Pumpherston power station is an 11-kV interconnector ; main substation at Philpstoun (11/3·3-kV transformer on the left)

Our thanks are due to Mr. R. Crichton, managing director, Scottish Oils, Ltd., for permission to visit the works and to publish this article, and to Mr. G. A. McLennan, chief electrical engineer, and Mr. W. Stirling, assistant electrical engineer, for their assistance in the preparation of the article.

Turbo-electric Locomotive

A GAS-TURBINE electric locomotive is to be designed and built at Baden, Switzerland, for the Great Western Railway, the order having been placed with British Brown-Boveri, Ltd.

It will be of 2,500 H.P. with a maximum continuous speed of 90 m.p.h., capable of hauling a trailing weight of 1,200 tons at speeds up to 40 m.p.h. continuously. The locomotive will be 65 ft 6 in. long and weigh 113 tons in running order, exerting a tractive effort of 33,000 lb at the wheel rim when starting. It will carry enough fuel oil for a journey of 250 miles, thus sufficing for a non-stop run from Paddington to Plymouth.

Air at 45 lb per sq in. gauge pressure will be delivered by a compressor (driven by the turbine) through a heat exchanger to a combustion chamber for consumption of the fuel oil. But the greater portion of the compressed air will be by-passed to be mixed with the hot products of combustion, so cooling them to about 1,100 deg F before the mixed gas is expanded through the turbine. The exhaust will pass through the heat exchanger, some of the heat recovered therein being transferred to the air delivered into the combustion chamber to raise its temperature to about 500 deg F.

The 10,300-H.P. turbine is to be coupled through speed reduction gear to a 2,500-H.P. electricity generator, the difference of 7,800 H.P. being absorbed by the air compressor. The outer axles of each of the two six-wheel bogies will be driven by d.c. series wound motors, controllable by one man from a cab at either end.

A less powerful locomotive of the same kind was built five years ago by Brown, Boveri for the Swiss Federal Railways.

Views on the News

Reflections on Current Topics

MY notes in the *Electrical Review* of November 15th included a reference to the fears of poultry farmers that interruption in electricity supply might upset their incubators. Mr. H. D. Phelps, of the North-Eastern Electric Supply Co., who has had many years' experience in these matters, assures me that there is no need to worry over short-term cuts in supply. His assurance has also been passed on to the secretaries of local branches of the National Farmers' Union in his area. In his letter he deals with the various types of incubators and brooders and quotes instances of prolonged stoppages which have had no ill-effect upon the eggs or chicks. To make assurance doubly sure he gives poultry farmers a few hints on protective measures.

* * *

What would be the electrical demand in a "fair-sized city?" I should have said not less than about 30,000 kW. Yet that appears to be somewhat excessive as an estimate of the input to one new flashing sign on Broadway, N.Y., as announced by the B.B.C., however many miles of neon tubing plus motors and, presumably, power-factor-corrective apparatus it may use. Matters have indeed moved since 1939, when what I was told was the largest-rated sign in Europe, or possibly in the world, was erected in Leicester Square, London. Its demand was, I believe, 30 to 35 kW.

* * *

The other day I saw privately a new film, "A Place in the Sun," which deals with one of to-day's leading topics—town and country planning. Beginning with some beautiful "shots" of English rural scenery, it shows how industry has encroached upon the country districts, with appalling results. Remedies are discussed by Lord Beveridge, Mrs. Elizabeth MacAlister, M.A. (Town and Country Planning Association), Mr. D. B. Williamson, B.Sc., A.M.I.E.E., and Mr. George Woodcock, M.A. (T.U.C.). One point at issue is whether industry should be taken to the workers or the workers taken to new up-to-date satellite towns in which industry "fits in." Anyhow, it is agreed that industry is no longer bound to the coal producing areas. The ubiquity of the grid system makes it possible to put factories anywhere, factories which, using electric power, can be really desirable places to work in. The public will be able to see the film soon and should obtain (probably without being fully aware of it) a good idea of the social revolution which electricity is achieving.

* * *

I also saw "Can We Be Rich?" a film which has already been shown publicly. In it Mr. Geoffrey Crowther (editor of the *Economist*) lucidly explains why the war has made us poorer and suggests how we can recover and even improve upon our former position. The secret of course is more p.m.h. (production per man-hour) which can only be achieved by the greater mechanization of industry—that is, of course, by greater electrification. I consider that these appeals to the public intelligence, which is greater than some film "magnates" imagine, will do much good nationally and electrically.

* * *

When applicants for admission to a trade association are turned down they are apt to think (and say) that the association is merely protecting its members from competition. This cannot be charged against the Birmingham branch of the Electrical Contractors' Association. Many men from the Forces and industry are now turning their hands to electrical contracting. They have had little or no business experience and many have no technical knowledge either. They all have to be turned down but the Birmingham branch is encouraging those who with a little more experience will be suitable for membership to apply again after a certain period. In the meantime a course of lectures has been arranged for their benefit in which various aspects of the contracting business are being dealt with.

* * *

Although many applicants for membership of the E.C.A. are rejected the admissions are running at a record rate. At its October meeting the E.C.A. Council accepted about ninety new members and re-admitted about a dozen whose membership had been suspended during the war for various reasons.

—REFLECTOR

Power Station Auxiliaries

Drive and Distribution Methods

SOURCES of, and methods of distributing power to, auxiliary plant in generating stations equipped with steam turbine sets of unit capacities of not less than 20 MW are analysed by MR. W. SZWANDER (Metropolitan-Vickers Electrical Co., Ltd.) in a paper read before the Institution of Electrical Engineers last week.

In some cases definite reasons can be traced for the adoption of particular systems, but in many others choice is still largely a matter of personal preference and judgment. The author himself refrains from expressing preferences and makes few recommendations, his object being to analyse the methods most commonly met with in practice.

In general the power of any auxiliary system may vary from 6 to 10 per cent of the installed capacity of the station, representing some 4 to 8 per cent of the station load and consuming from 4 to 8 per cent of the total energy generated. Some 10 to 15 per cent of the auxiliary capacity is classed as representing "non-essential" services and is energized from the main station busbars.

All-Electric System

Modern practice favours all-electric auxiliaries; some cases are known in which no steam drives are provided at all. On economic grounds alone it is difficult to obtain a definite answer in favour of one or the other type of drive. At present the general rule is to use a.c., but there are a few purposes for which d.c. motors are still the best with respect to speed control. Voltages most used are 415 V and 3·3 kV, the latter for motors larger than 75 to 125 H.P., but it is impossible to specify precisely the rating above which it is better to use high voltage. There is much to be said for the method sometimes used of connecting small low-voltage essential motors to the terminals of associated high-voltage motors, through individual transformers, with starter switches on the low-voltage side.

For the sake of reliability the principle of subdividing, or duplicating, all the essential auxiliary motors is strongly recommended. The simplest form of radial distribution can be employed, without duplication of feeders, transformers, or busbars. Double busbar arrangements of metalclad switchgear should not be used as a means of ensuring duplicate supplies to outgoing feeders.

More than half the paper is devoted to sources of power for auxiliary drives. Details of various systems and their specific features are discussed with the aid of circuit diagrams. The simplest and by far the cheapest method is through unit transformers from the main station busbars.

Auxiliary power derived from the main generator terminals has a greater degree of immunity from system disturbances, while the use of an auxiliary generator coupled directly to the shaft of the main turbo-set is a further step in the same direction. They are used fairly frequently in British stations, but are not economical for main sets of less than 20 MW. By comparison with shaft generators, the few and limited advantages, if any, which could be ascribed to the provision of separate auxiliary house sets are heavily off-set by a number of disadvantages, including considerably greater first, operating and maintenance costs.

It may be good practice to install, at least in some stations at strategic points in an interconnected system, Diesel driven generating sets to provide energy for starting plant "from cold" in the event of a complete system shutdown.

The paper concludes with a bibliography of 36 references to the subject in British, American, German and French publications.

Discussion

Opening the discussion, MR. F. C. WINFIELD (Merz & McLellan) agreed that the steam driving of auxiliaries was "dead" and that when used to-day it was by way of emergency standby. For nearly fifty years the "unit" transformer arrangement had been used without much trouble. It was cheaper and inherently more reliable and simpler, but he would not join issue with anybody who decided in favour of the unit generator. It was possible to do more harm by duplicating than by sticking to a straightforward system. The squirrel cage motor was the most robust, simplest and cheapest for constant speed drive. Variable-speed motors were needed for boilers and fans; group control or the unified Ward-Leonard system would ensure a much better efficiency of the boiler, but he did not care for automatic control which seemed to be better

for fluctuating loads which were exceptional here.

MR. C. W. MARSHALL (Central Electricity Board) suggested that there was a tendency to exaggerate the difficulties of power supply to station auxiliaries. If one looked at an outdoor substation it would be realized that a very high degree of reliability could be obtained under conditions compared with which power station services were easy in the extreme. More attention should be given to simplifying and avoiding duplication of auxiliaries. Where exactly was duplication justified at all? The shaft alternator was more costly, less efficient, less reliable and more cumbersome than the " unit " transformer. Admittedly it was shielded from voltage disturbances to a certain extent, but with continually increasing effectiveness of fault clearance, he would like to be convinced. At the moment, he saw no justification at all for shaft alternators. In advocating the avoidance of duplication he said there must be better measurement of auxiliary power in order to ascertain whether things were changing. As regarded the power required for governor and oil circulation, he did not think there was any less efficient method of providing a few watts than by a big clumsy worm gear on the end of the shaft turbine. A servo motor could do the job.

" Unit " and House Transformers

MR. H. PRYCE-JONES (Brighton) said that the simplicity of the author's " unit " system without duplication or subdivision of the essential auxiliary motors was attractive. The unit transformer attached to each turbo-alternator should deal with all the auxiliaries of the one machine and its associated boilers, with probably one house transformer to each half of the station, capable of dealing with the complete auxiliaries of one turbine and its boilers, plus the capacity of half the " non-essential " services. A further safeguard, but also an additional complication and source of possible failure, would be some automatic device whereby in the event of the failure of a " unit " transformer, the essential auxiliaries could be changed over quickly and smoothly to the house transformer. If sufficient thought were given to certain points in the initial design of a station, a house set or house alternator driven by the main set did not appear to be essential. Temporary drops in voltage or frequency could be met by motors designed to run at 75 per cent of normal voltage for, say, three minutes with normal frequency; or at 90 per cent normal frequency and/or 90 per cent normal voltage for, say, 30 minutes.

MR. J. H. C. PETERS (English Electric Co.) said the paper made no mention of the switchgear for controlling the supply.

MR. G. T. SHEARS (Central Electricity Board) said that for combustion control Ward-Leonard equipment in conjunction with mercury-arc rectifiers had considerable scope. The hydraulic coupling was inefficient for constant torque drives. Since the fuel situation was serious, economy in the supplying of power to auxiliaries was very important. Works power consumption of 5 per cent was a usual figure.

MR. W. N. C. CLINCH (Northmet Co.) said that there was no reason why switchgear for station auxiliary power should not be placed in a proper switch room. He shared the view that the house set was rather a nuisance. One should bear in mind present facilities. For instance, in the event of a circulating pump shutting down the turbine could, as the result of absolute back-pressure in the condenser falling, be in itself unloaded so that the condenser did not become a boiler. It was a pity safety valves had to be used. The use of electricity for assisting the safety valve to open and shut positively was well worth while; he had actually done it. He doubted whether some of the devices for controlling boiler auxiliaries, some of fairly large H.P., were worth the bother entailed. He advocated a central control board with push-buttons and means of watching closely the regulation of all the auxiliaries.

MR. D. E. GAZE supported the idea of a separate switch room for the auxiliary switchgear as the increased reliability would well justify the extra cost.

Author's Reply

In his reply MR. SZWANDER said that several speakers preferred the " unit " transformer to the shaft generator. He knew of cases in which the two were very near to each other and the shaft generator was the cheaper alternative. He had not advocated either. Any differences in first cost and efficiency would be very small and the economic factor would decide. He was surprised to hear Mr. Winfield say that he expected half of the auxiliaries would be in the " non-urgent " class. He would have expected much less would be in that class, especially considering modern power stations operating under comparatively high steam pressure conditions, where the power demand of the boiler feed pumps had increased considerably.

With the present degree of interconnection between power stations under normal conditions, they would probably be prepared to lose a unit rather than have the additional complication of duplication. He agreed with Mr. Winfield with regard to automatic control. As regarded the shaft generator being cumbersome, this largely depended on the layout of the station. He also agreed that more attention should be given to the proper design of separate control rooms for auxiliaries.

Replying to Mr. Pryce-Jones, he said there was a long description of a device at the St. Denis power station in Paris in the Bulletin of the Société Française des Electriciens of 1937 for electrically operating steam valves, which closed when the electrically measured load of the set dropped below a certain minimum. One Ward - Leonard system with mercury - arc rectifiers was going into service shortly and a number of other installations were also in hand by the firm with which he was associated.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Electric Motor Enclosure

FURTHER to Mr. H. E. Summerguth's letter in your last issue may I suggest the definition given in paragraph MG50-26 of the "Motor and Generator Standards," published by the National Electrical Manufacturers' Association of New York:—

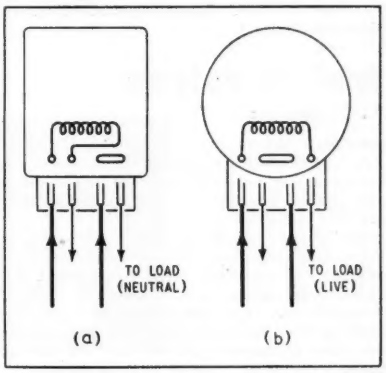
"A submersible machine is one so constructed that it will operate successfully when submerged in water under specified conditions of pressure and time."

If for "water" the word "liquid" is substituted, this would meet most practical conditions.

Chislehurst, Kent. A. N. D. KERR.

Meter Change and Polarity

CORRECT polarity of a single-phase installation has become a matter of first-rate importance since the adoption of single-pole distribution fuse boards and



Polarity reversal on meter change

undertakings have to be constantly on their guard against the possibility of a reversal. Although this could happen long after the installation has been checked and left in order, the undertaking would doubtless be called to account for any untoward result.

One possible cause of reversal, for which the undertaking would be responsible, may not have been generally noticed. There are probably many single-phase meters still in circuit that have the sequence of connections shown in sketch (*a*). If a meter of this style be replaced by one with a standard B.S. terminal block and the cables left in their original relative positions, the result would be a reversal of polarity of the whole installation, as shown in sketch (b). Routine checking after any work at the meter or service point should be regular practice to guard against such a possibility.

Sunderland. P. RIDLER.

Small Workshops

IN his "Everybody's Political What's What," Mr. George Bernard Shaw refers to "House to house distribution of electric power enabling workshops to knock out factories as factories knocked out cottage industries." That there may already be a trend in this direction is shown by the increasing number of small workshops lately coming into existence whose establishment has been greatly facilitated because electricity is available.

It is rather novel to come across a small workshop, all complete, in a shed at the back of the proprietor's residence and showing a substantial output. The monumental mason and sculptor uses electrical aids to reduce labour, and sometimes has his workshop adjoining his residence, making use of his domestic service to bring power to his workshop. Among other such jobs off the beaten track are those with motors up to 10 H.P. driving saw benches in sheds for spare-time joinery, making wood crates, cutting firewood, or operating a small motor-driven colour spray.

With these examples in mind it seems not too imaginative to wonder if the house-to-house distribution of electricity we are achieving to-day may not bring about a partial return of cottage industries and thus in some ways complete the industrial cycle. The new housing estates with their community centres seem eminently suited to this and one can imagine some organizing genius integrating these potential resources in much the same way as the production manager does in any modern factory. It seems to the writer, after looking over a mass-production factory employing all female labour, that many of the operations might be done just as well in the more congenial surroundings

of the home, as was often arranged during the war.

Electricity, in conjunction with other modern conveniences has reduced drudgery in thousands of homes to a remarkable extent. There must, therefore, be thousands of women—and many men too—who would welcome some remunerative way of occupying a few hours daily, instead of forming a new and enlarged "leisured class."

Sunderland. P. RIDLER.

Miracles Do Happen

DR. ALFRED RUSSELL WALLACE gives this definition:—"A miracle is the physical action of an intelligent agent producing results to which known laws are inadequate." By this definition miracles have been happening to me, and although I cannot at this stage go into details, I can say that substantial sums of money have come to me in a miraculous manner.

Few people will believe this unless it can be proved to them. Now nothing talks so effectively to materialistic minds as money, so I enclose a cheque for £100 payable to the Electrical Industries Benevolent Association. As a working man I should normally be quite unable to afford to give away such a sum.

As I see it the purpose of the intelligences responsible for these phenomena is not just to provide funds for charities, but to enable propaganda to be made for God. My reasons for asking you to devote space in a technical journal for this matter are:—

(*a*) It is more important that scientific minds should declare themselves against materialism, thus giving the lead to the rest of the world.

(*b*) Scientific progress will be much more rapid and its application much more beneficial to mankind, if scientists realize the implications of these miracles and open up their minds to the Source of all intelligence.

(*c*) This journal is read by business people and there is a great need for that class, among others, to "Seek first the Kingdom of God."

"PENNIES FROM HEAVEN (A.M.I.E.E.)."

[This letter would not ordinarily have been included in the columns of the *Electrical Review* but for the fact that that is a condition of the payment of the contribution of £100 to the Electrical Industries Benevolent Association. We are glad to find space for the letter in order that the E.I.B.A. should benefit.—EDITORS, *Electrical Review.*]

Drives for Ships' Services

Advantages of A.C. Equipment

SHIPS' electrically-driven auxiliary machinery is found to be more costly to purchase but, excepting special cases, is much cheaper to operate than equivalent steam-driven plant. Hitherto d.c. at 100 V and latterly at 220 V has been employed, the equipment being entirely satisfactory and comparing favourably in performance with steam-driven auxiliaries, on which basis most marine plant is still judged. But the utilization of a.c. in ships has been visualized for a long time and rules for its installation have been formulated by the various classification societies as well as the Institution of Electrical Engineers.

The several types of a.c. motors that might be employed, their performances and methods of starting them are compared by MR. A. PORTER (English Electric Co., Ltd.), in a paper presented this week in London to the Institute of Marine Engineers. The changeover would not necessitate any radical alteration of types of driven auxiliaries, although operation at constant speed would need to be more generally adopted.

Auxiliaries driven by a.c. motors would be advantageous in ships propelled by a.c., taking energy from the main circuit, or from secondary alternators driven in tandem with the main sets. Otherwise auxiliary turbo-alternators for use at sea and Diesel-alternators for use in port can be designed to work satisfactorily in parallel.

The paper includes detailed particulars of several ships, Continental, British and American, utilizing a.c. auxiliaries wholly or in part and performance under variable speed conditions is considered. Tabulated data of the auxiliaries likely to be fitted in a modern a.c. ship indicate the types of motors and methods of starting them.

Cargo-handling winches are still difficult to convert to a.c. because a no-load speed of from four to five times the winding speed is needed. Reports from Germany indicate that a.c. winches were developed during the war years. Continental shipbuilders are understood to be inquiring for such machines and experiments are being conducted in America.

Three-phase distribution at 400 V and 60 c/s is being favoured for marine work; the frequency generally used for propulsion is from 50 to 80 c/s. Circuit division and voltage transformation facilities should tend to cheapen installations and render them more reliable.

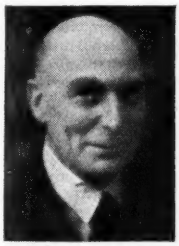
PERSONAL and SOCIAL

News of Men and Women of the Industry

WITH the purpose of furthering the mutual arrangements which have existed for some years in the development of electricity supplies in the large adjacent areas south of the Thames, the **Hon. Eric Butler-Henderson** has joined the boards of the County of London Electric Supply Co., Ltd., and the South London Electric Supply Corporation, Ltd., and **Sir Robert Renwick, Bt., K.B.E.**, has joined the board of the London Electric Supply Corporation, Ltd. Mr. Butler-Henderson is chairman of the London Electric Supply Corporation and Sir Robert Renwick is chairman of both the County Co. and the South London Corporation.

At the I.E.E. meeting on December 5th, the President welcomed six engineer officers of the Royal Dutch Forces who, he said, were on a mission to this country and had been invited to the meeting. **Lt. Col. Kok** (Royal Netherlands Army), expressing appreciation of the welcome, said that before the war Holland had a considerable trade with Germany. That was not now possible and it was necessary to look for contacts in this country and perhaps also in America in order to obtain equipment, especially signalling apparatus. He expressed the hope that the Institution would help them in securing this equipment.

The Nottingham City Council has confirmed the appointment of **Mr. M. Wadeson, M.I.E.E.**, as city electrical engineer and general manager of the electricity undertaking, in succession to Mr. G. H. Lake, M.I.E.E., F.I.F., who, retired from that post in August last. Mr. Wadeson was educated at the Municipal Technical College, Portsmouth, and his first appointment was with the Newcastle Electric Supply Co., after which he was with Merz & McLellan. His next appointment was with Mr. W. M. Selvey, consulting engineer, and he was in charge of Mr. Selvey's Sheffield office for many years. He was appointed technical and personal assistant to Mr. Lake in 1934, and became deputy electrical engineer at Nottingham in 1939. He served with H.M. Forces in the 1914-1918 war, first in the Royal Engineers and later in the Royal Tank Corps with the rank of major. Whilst at Nottingham, he has been closely associated with the I.E.E. East Midlands Sub-Centre, of which he is a past chairman; he is also a past chairman of the I.E.S. Nottingham Branch, and a member of the Nottingham Society of Engineers.



Mr. M. Wadeson

Mr. A. M. Bryan has been appointed Chief Inspector of Mines by the Minister of Fuel and Power in succession to **Sir John Felton,** who is retiring. He will take up the duties early in the New Year.

Mr. Harry S. Ellis, M.I.E.E., M.I.Mech.E., who has been general manager and chief engineer to the West Gloucestershire Power Co., Ltd., for over twenty-three years, is retiring

Mr. H. S. Ellis

Mr. W. Hill

as from December 31st next, and is being succeeded as chief engineer by **Mr. W. Hill,** M.I.E.E., who has been with the company since its inception and has for a number of years acted as chief assistant engineer to the general manager.

Mr. Ellis was educated at St. Bees School, Cumberland, and received his technical training as a pupil with the Cardiff Corporation and at Cardiff Technical College. In 1904 he was appointed assistant engineer in the Cardiff Corporation Electricity and Tramways Departments, and three years later took up the position of chief assistant electrical engineer with the Bradford Corporation, and he subsequently became deputy city electrical engineer and manager. In 1912 he was appointed borough electrical engineer of South Shields, and in 1919 went to a similar position at Southampton. In the following year, however, he set up in in practice as a consulting electrical engineer (A. Ellis & Partners, Cardiff), and three years later became chief engineer and general manager of the West Gloucestershire Power Co., Ltd. He was chairman of the Western Centre of the Institution of Electrical Engineers for the 1938-39 session.

The board of the West Gloucestershire Co. has appointed **Mr. G. D. Johnstone,** A.C.A., as general manager as from January 1st and **Mr. V. C. Bastin,** A.L.A.A., A.C.I.S., as secretary. Mr. Johnstone joined the company in June, 1939, as chief accountant and was appointed secretary in 1942. Mr. Bastin became associated with the company in 1942 as senior accounting assistant, and became assistant secretary in October, 1944. Similar appointments to the

above have been made for the wholly owned subsidiary company, the Chepstow Electric Lighting & Power Co., Ltd.

Mr. W. H. Metcalfe, A.M.I.E.E., borough electrical engineer at Morley, Yorks, was provisionally appointed electrical engineer and manager to Long Eaton Urban District Council, in succession to **Mr. J. Barnett Feltham** at a Council meeting on December 5th. Mr. Metcalfe went to Wakefield Academy and the Institution of Technology, Wakefield, completing his training with the Wakefield Light Railway and the Yorkshire (W.R.) Electric Tramways Co. After serving in the Forces in the 1914-18 war he became engineer assistant to the latter company, and two years later was appointed resident engineer to the Pontefract electricity undertaking. He became engineer and manager with the Bacup electricity undertaking in 1931, and left there in 1945 to take up his present position at Morley. Mr. Feltham is retiring in February next having held the position of electrical engineer and manager at Long Eaton since 1923.

Mr. W. H. Metcalfe

At the meeting of the London and Home Counties Joint Electricity Authority held on December 5th, **Mr. H. E. Goodrich,** J.P., M.P., was elected chairman and **Councillor W. H. Shaw,** vice-chairman of the Authority.

Mr. B. Fisher, A.M.I.E.E., technical assistant to the chief electrical engineer of Tube Investment (Group Services) Ltd., Birmingham, has been appointed power installations engineer with the Sheffield Corporation Electricity Department at a commencing salary of £597 per annum. **Mr. T. Bryan,** B.Sc., assistant engineer with McLellan & Partners, and **Mr. A. Swift,** acting installation engineer with Sheffield Electricity Department, have been appointed installation engineers at Sheffield at commencing salaries of £478 per annum.

The Johnson Matthey Dramatic Society gave three fine performances at King George's Hall, London, W.C.1, last week of " Death Takes a Holiday," by Alberto Casella (rewritten by Walter Ferris). This play, in which " Death " becomes mortal for three days and in the guise of a prince becomes the guest of an Italian Duke at his castle, provides some amusing dialogue and also some tense moments. A strong cast headed by Mr. Frank Braby as " Death ", and the Prince, gave point to the various situations, grave and gay, and made an improbable story sound convincing. Miss Freda Webb, as " Grazia," whose love for the Prince surmounts the fear of death and accompanies him when he divests himself of mortality, gave a moving performance of ethereal charm. Admirable support was given by Wilfrid Jones, Hugh Walker, Ray Harries, Lawrence Hyatt, Leslie Beer and John Shirreff, and Łydia Lyons, Mildred Harker, Irene Robson, Kathleen Bonner, and Muriel Dru.

Mr. G. A. Nicholson, general manager of Fife Electric Power Co., will shortly retire under the operation of the age limit. He has been associated with the company since 1909, first as secretary of Fife Tramway Light & Power Co., Ltd., and later as secretary of Fife Power Co. On the death of his predecessor, Mr. James Thomson, in 1929, Mr. Nicholson was appointed general manager. As we reported in our last issue, Mr. Nicholson will be succeeded by **Mr. W. S. Sawtell,** M.I.E.E., at present general manager of the Scottish Southern Electric Supply Co., Ltd.

Mr. C. M. Isherwood, M.Eng., A.M.I.E.E., temporary engineering assistant, Liverpool Corporation Electric Supply Department, has been appointed assistant high-voltage engineer in a permanent capacity. **Mr. W. Cook,** control room engineer, Lister Drive station, now fills a similar position at Clarence Dock Station; **Mr. H. L. Quayle,** control room engineer, Clarence Dock, has been appointed electrical maintenance engineer.

Mr. A. G. Milne, A.M.I.E.E., technical superintendent with the Blackburn Corporation Electricity Department, has been appointed deputy city electrical engineer at Bath. Mr. Milne received his engineering training at Faraday House, and in the steam and electrical test departments and research department of C. A. Parsons & Co., Ltd. After a period on the staff of this company, he joined the County of London Electric Supply Co., Ltd., as junior charge engineer. His next post was as assistant district engineer with the Yorkshire Electric Power Co., and from there he joined Thos. Firth & John Brown, Ltd., Sheffield, as assistant works manager in the Engineers' Tool Department. Mr. Milne returned to the Yorkshire Electric Power Co., in 1939, and successively held the appointments of construction and senior technical assistant in the mains construction department, and technical assistant in the operation department. He joined the Blackburn undertaking in 1945. While he was in Yorkshire, Mr. Milne served as assistant hon. secretary of the North Midland Centre of the Institution of Electrical Engineers.

Mr. A. G. Milne

The following staff changes have been made in the Barking Corporation Electricity Depart-

ment:—**Mr. H. A. Matthey,** A.M.I.E.E., of Islington, has been appointed assistant installation and meter superintendent; **Mr. J. G. Boggis,** Graduate I.E.E., of Bethnal Green, has been appointed second mains assistant; and **Mr. P. Stevens** has been promoted to mains records assistant.

Mr. K. M. Sowerbutts, assistant mains superintendent with the Bedford electricity undertaking, has been appointed assistant mains superintendent at Bath, and **Mr. L. Locker,** assistant mains engineer with the Rotherham Corporation electricity undertaking, has been appointed testing engineer (mains) at Bath.

Mr. J. Yates, of Walsall, has been appointed mains engineer to Bolton Corporation Electricity Department at a salary of £662 per annum.

Mr. G. A. White has been appointed installation superintendent with Wallasey Corporation Electricity Department at a salary of £479 per annum.

West Bromwich Corporation Electricity Committee has appointed **Mr. M. Nicholls,** of Heston, as chief commercial assistant in succession to **Mr. P. H. Flatt,** who has resigned.

Mr. E. Barrie has resigned his position as development engineer with Elexcel, Ltd., and has been appointed works superintendent of H. Fisher (Oldham), Ltd.

Mr. R. E. J. Harding, A.M.S.E., A.I.A.S., who has been with the Wimbledon Corporation for nineteen years, is leaving shortly to join the London & Home Counties Joint Electricity Authority in the capacity of building surveyor.

An autumn dance, jointly organized by the North Western Students' Section of the I.E.E. and the North Western Graduates' Section of the Institution of Mechanical Engineers, was held on November 30th at Manchester Limited Restaurant, Manchester, and there was a large attendance representing both Sections. The guests included Mr. E. T. Norris, chairman of the North Western Centre of the I.E.E.

Obituary

Mr. Q. Arbuckle.—We regret to record the death of Mr. Quentin Arbuckle, mains superintendent with Bradford Corporation Electricity Department, which occurred on December 3rd at the age of sixty-three years. Mr. Arbuckle obtained his early experience with Crompton Parkinson & Co., Ltd., and the Doncaster Corporation Electricity Department. He joined Bradford Corporation Electricity Department in 1905 as draughtsman, and subsequently held the posts of mains assistant and mains engineer, and was appointed mains superintendent in 1941. He took an active part in the planning and development of the new 33-kV system and the primary substations connected with it.

Mrs. Harold Hobson.—We extend our deepest sympathy to Mr. Harold Hobson, chairman of the Central Electricity Board, upon the death of his wife, Mrs. Coralie Hobson, on December 4th.

Mr. T. D. Trees.—The death occurred on November 29th of Mr. Thomas Dennis Trees, A.M.I.E.E., of the Electrical Engineering Department, Admiralty.

Wills.—**Mr. J. F. Jones,** of Woking, Surrey, retired electrical engineer, who died on September 9th last, left £44,971 gross, with net personalty £42,426.

Mr. A. M. H. Walrond, a director of Calcutta Electric Supply Corporation, who died on June 24th last, left £13,251 gross, with net personalty £12,658.

Mr. H. C. T. Westlake, of Donnybrook, Kings Drive, Eastbourne, late borough electrical engineer of High Wycombe, who died on January 25th last, left £10,632 gross, with net personalty £10,572.

Mr. S. E. Britton, formerly city electrical engineer of Chester, left £5,363 (net personalty £5,240).

Welding Research

THE programme of work contemplated by the British Welding Research Association indicates how widely diverse are the uses of welding in the engineering and the metal construction industries. The investigations are broadly divided into four categories, each directed by sub-committees, under the guidance of a main committee, under the chairmanship of Dr. H. Harris (Babcock & Wilcox, Ltd.) in the case of metallurgical aspects, of Prof. A. G. Pugsley (Bristol University) in respect of engineering factors, of Dr. H. Sutton (Ministry of Supply) for light alloys and of Dr. H. O'Neill (L.M. & S. Railway) for resistance welding.

In addition to the small-scale laboratory work at the Association's headquarters in London, at the moment mainly concentrated upon the weldability of the newer kinds of steels and the hot cracking of arc-welded aluminium and magnesium alloys, a new establishment at Cambridge is to concern itself with the fundamentals of structural work and pressure vessels to see if predictions can be fulfilled in practice. It is hoped in due course to subject the initial findings to full-scale tests in order to determine the real margins of safety of the more rigid welded structures by comparison with the factors of safety usually allowed for relatively flexible riveted structures. Such experimental tests will be conducted on the site of a large Georgian house standing in 25 acres at Abingdon in Berkshire.

But to enable full-scale investigations to be proceeded with quickly enough the Association will need to enlarge its membership in order to qualify for larger D.S.I.R. grants-in-aid, which is one of the reasons why the Association and Institute of Welding separated and became independent entities.

A.C. Motor Starters—II

Protection Against Single-Phasing and Earth Faults

By "Rotor"

SHOULD one supply line to a three-phase motor become open-circuited the motor would not be self-starting, but it would continue to run if the fault occurred after starting with an increased current in the motor windings. In a star-connected motor the increase of current in the two sound lines would be the same as the increased current in the motor

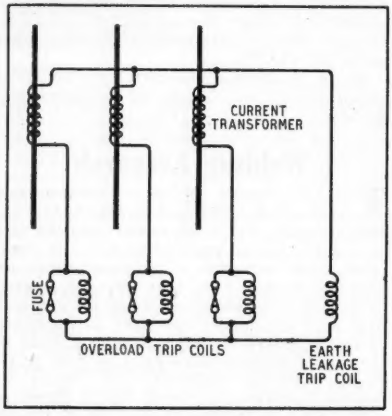


Fig. 4.—Connections of earth-leakage trip and overload trip coils with time-lag fuses

windings that remained connected to the supply; line-overload trips thus afford the same degree of protection against this fault as against ordinary overload.

In a delta-connected motor, as used with a star-delta starter, the current in the phase of the motor windings connected across the two sound lines may be appreciably greater than in the two lines, so that normal overload trips may fail to give complete protection. If the trips can be set to function at 25 per cent above the actual load current of the motor, an open-circuited line should raise the line current above tripping value. Where this cannot be done, as when a motor works on a varying load, a starter having special protection against single-phasing might be considered. In one make single-phasing protection is combined with the overload trips. The magnetic trip is arranged to operate on overload or if the current in any line falls below a value that is less than no-load current. The bi-metal trip operates on overload or if the current in the three phases becomes appreciably unequal by having trip bars above and below the bi-metal strips, which separate and open the trip contacts if the curvature of the strips becomes unequal.

Where direct earthing is relied upon for the protection of large motors a very low-resistance earth must be maintained to ensure that sufficient current passes through the overload trips or fuses to cause operation with earth faults; where this is impracticable, leakage trips may be fitted. These trips can be current-operated and based on the principle that the algebraic sum of the currents in the three supply lines should normally be zero. This principle can be applied by passing the three supply leads through a ring-type current transformer with its secondary output fed to a trip coil or by combining the secondary outputs of three

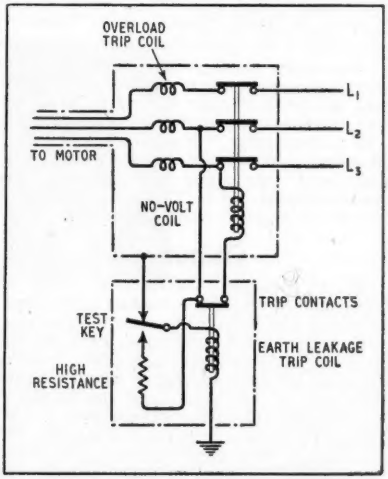


Fig. 5.—Connections of voltage-operated earth-leakage trip controlling motor switch

separate current transformers as in Fig. 4. If some of the input current returns to the

Part I of this article appeared on November 22nd.

supply plant through earth the resultant current in the trip coil will cause it to operate.

An alternative is to use a voltage-operated earth-leakage trip (Fig. 5), the metallic sheathing of the conductors being connected to earth through a trip coil which is responsive to a fraction of an ampere leakage current and de-energizes the starter no-volt coil. It usually functions if the voltage of the metalwork reaches not more than 40 V above earth.

Means should be provided to prevent the rotor starting resistance of a slip-ring motor being cut out before the stator switch is closed, but some of the mechanical interlocks provided are not wholly reliable. Combined stator and rotor starters operated by a single handle have an advantage. The rotor starter should merely control and not open the resistance in the rotor circuit.

A further interlock, usually consisting of an auxiliary switch which is opened when the slip-rings are short-circuited and connected in the no-volt circuit, is desirable. A good arrangement of electrical interlocks is shown in Fig. 6. The stator switch cannot be closed until the interlocking no-volt coil (N) is energized by the initial movement of this switch, which closes auxiliary contacts A_1 and A_2 provided the rotor starter is in the off position to close contacts B and the slip-ring device is in the starting position to close contacts D. When the switch has been closed the rotor starter resistance can be cut out, and the slip-rings short-circuited after the contacts C have been closed by the rotor starter.

An isolating switch interlocked with the starter should be provided to prevent the latter from being opened or the oil tank from being lowered until after isolation. A large starter may be horizontally or vertically isolated by a movement that disconnects plugs from their sockets after the starter has been tripped.

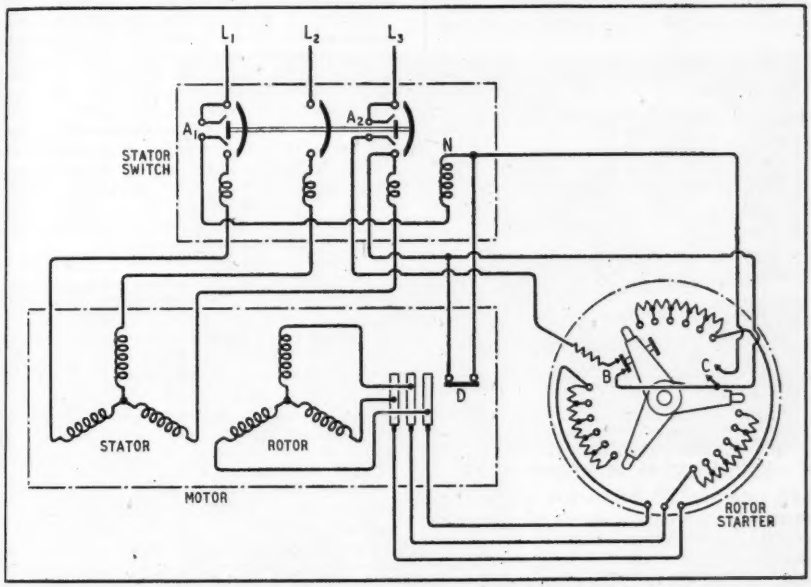


Fig. 6.—Connections for three-phase slip-ring motor with interlocked starting gear

Many a.c. starters are specified to be capable of interrupting six times full-load current. As the possible fault current may be much greater, some form of back-up protection is required and high-rupturing-capacity cartridge fuses are very suitable. Fig. 7 shows the characteristics of a fuse designed to operate more quickly than overload trips on more than five times full-load current; with such a fuse it is advisable to consider whether the starter can safely close the circuit on a pre-existing serious fault.

Most non-automatic starters, with the

exception of the direct-on-line type, are fitted with mechanical or electrical interlocks to ensure that the control gear is used in the correct sequence—an important feature where unskilled labour is employed. Star-delta

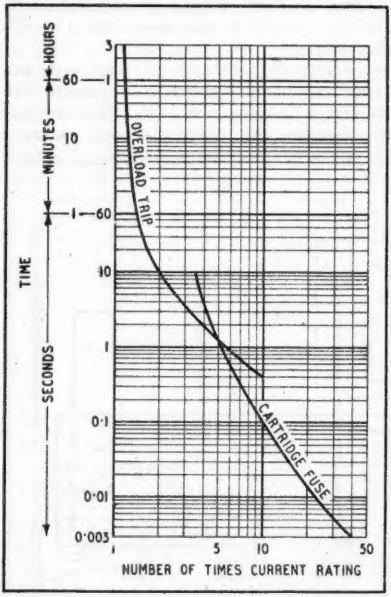


Fig. 7.—Operating characteristics of one type of thermal overload trip and cartridge fuse

and auto-transformer starters of the hand-operated types have a device to prevent the control handle being moved to the running position before it has first been placed in the starting position or if the change-over is not made swiftly. Such devices may be a simple form of catch controlling the handle, preferably inside the starter case where the starter is in a dirty or damp position. It is a defect of many starters that they have no automatic means, such as the oil dashpot provided on some, of compelling the operator to pause in the starting position long enough to enable the motor to accelerate to a steady speed.

Atmospheric Electricity Research in Russia.—According to the *Soviet News*, a new laboratory for the study of atmospheric electricity was recently inaugurated in connection with the Central Geophysical Observatory at Seltsy, near Leningrad. A laboratory for research work in connection with the ionosphere is also being established in the same buildings.

Municipal Reports

Preston.—Consumption of electricity in the undertaking's area last year showed little change in the aggregate (123·8 million kWh compared with 123·3 million in 1944-45). There was, however, a continuation of the decline in industrial power supplies, which have fallen by 30 per cent since the " peak " year of the war—1943-44; i.e. from 53·4 million kWh to 37·6 million. The textile industry provides scope for considerable expansion, a survey of the area revealing that if all this load were taken from the undertaking's system there would be an addition of approximately 11,000 kW.

Mention is made by the borough electrical engineer (Mr. G. A. Robertson) in his report of a reorganization and extension scheme which is being carried out in the consumers' department with the object of providing a comprehensive service free of cost to the user.

Through new plant commissioned at the end of 1943 being due for inspection and annual overhaul, there was a reduction in kWh generated from 426·3 million to 348·9 million. The new Ribble No. 2 station (see *Electrical Review*, September 7th, 1945) showed a thermal efficiency of 22·38 per cent.

Revenue during 1945-46 aggregated £1,035,879 (against £995,306), with working expenditure at £922,811 (£859,345) and after providing for loan charges, etc., there was a net surplus of £3,907 (£16,455), before allowing for £14,267 (£7,448) capital expenditure out of revenue. The average price received per kWh sold, excluding bulk supplies, was 1·088d.

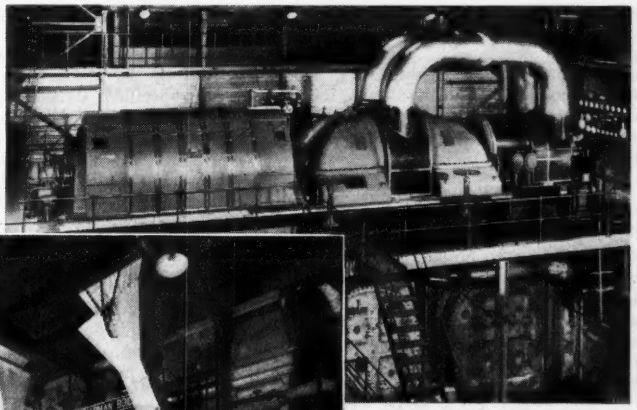
Cheltenham.—The borough electrical engineer and manager (Mr. R. W. Steel) reports that during 1945-46 the trend of the undertaking's business was similar to that of the preceding year, sales for power purposes continuing to decrease while domestic supplies showed a marked tendency to expand very rapidly. Actually, under the power and contract rate consumption decreased by over 19 per cent to 11·8 million kWh, against which under the combined lighting, heating and cooking rate there was an increase of over 14 per cent to 12·0 million kWh. Overall consumption, at 36·4 million kWh, was down by just under a million kWh. Exclusive of meter rents, etc., the average price received per kWh sold was 1·39d. against 1·37d. in 1944-45. Total income last year amounted to £231,909 (£225,027) with working expenses at £203,772 (£180,849) and after meeting loan charges and income tax, etc., there was a net deficit of £1,720 compared with a profit of £4,428 in the previous year. With £8,597 spent on capital items the balance brought forward has been reduced from £27,091 to £16,774.

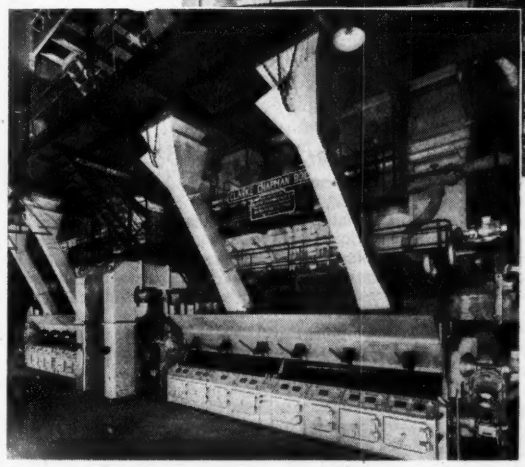
Through a printer's error the average price received per kWh sold at Huddersfield last year was given in our November 29th issue as 0·080d. instead of 0·80d.

Extensions at Hull

Opening and Jubilee Celebrations

THE starting up of a new 30,000-kW generating unit at Sculcoates power station last Saturday by Mr. Emanuel Shinwell, Minister of Fuel and Power, provided the first appropriate opportunity for celebrating the jubilee of the Kingston-upon-Hull undertaking. Supply was first switched on in the borough on January 16th, 1893, from the Daggers Lane 300-kW station to 148 consumers in an area of 15 sq miles. The area was subsequently extended by stages to 162 square miles, and during the twelve months ended March 31st last nearly 100,000 consumers took 280 million kWh out of a total of 348 million kWh generated for a consumption of 233,000 tons of fuel. The maximum demand was 90,495 kW which was carried by 99,000 kW of plant.





New 30,000-kW set and boilers at Hull

The capital outlay on the undertaking, including the £900,000 estimated for the new plant, is now approximately £6,700,000. An unusual feature of the extension is that the Central Electricity Board originally directed that the capacity of the station should be increased to 124,000 kW by September, 1948, but later developments necessitated advancing the date for completion by two years.

The new 30,000-kW turbine is a G. E. C., Fraser & Chalmers 3,000-r.p.m. two-cylinder machine. Steam at 375 lb per sq in. and 800 deg F enters the 22-stage high-pressure cylinder at the end near the centre of the set, in order to ensure cooler governor and oil-pump gear, and exhausts to the centre of the low-pressure cylinder in which it traverses six stages each way. Approximately 1,600 gallons of light oil is circulated to the bearings through coolers.

Mirrlees-Watson twin condensers maintain a pressure of 1·5 in Hg at the turbine exhaust, for which 1,250,000 gal of cooling water per hr is required. The 4,396 brass tubes in each were expanded by means of an electrically-driven automatic device controlled by a sensitive current-limiting relay; this gives a push-out strength of nearly one ton, i.e., a factor of safety of four on the maximum thrust exerted on the tube plate. Condensate is dealt with by a 47-H.P. pump and its temperature is raised from 80 to 315 deg F for boiler feed by steam extracted from the turbine at 13·4,

36·4 and 105 lb per sq in. at 80 per cent loading. A vacuum relay progressively throws off load should the vacuum fall below 24 in. A 15,000 lb per hr triple-effect vapour-compression evaporator of the Prache and Bouillon type, made by Aiton & Co., has a steam consumption of 2,830 lb per hr.

Of the total weight of the complete set of 400 tons the stator of the G.E.C. alternator accounts for 95 tons; it is wound for 22-kV and is cooled by integral fans. The rotor, 21 tons, is cooled by air flowing towards the centre and then out through slots in the stator iron, the aim being to avoid rotor coil distortion. Separate excitation has been adopted. The designed heat consumption of the set at rated output is 10,945 B.Th.U. per kWh generated. New high-voltage switchgear comprises eight 22-kV and nine 6·6-kV panels by Reyrolles; the latter include the control of Metrovick reactors for restricting fault kVA on existing switchgear to 500,000.

Steam-raising Plant

Steam is raised at 400 lb per sq in. and 825 deg F in two 190,000 lb per hr three-drum Clarke-Chapman boilers with Murray fin water-cooled furnaces which are fired by International Combustion chain-grate stokers. These have been installed in the space formerly occupied by two 50,000 lb boilers. They are equipped with superheaters of the horizontal self-draining type of the Superheater Co.'s make. Feed at 250 deg F is raised in temperature to 355 deg before entering the rear top drum through a Copes "Flowmatic" regulator. Davidson draught plant comprises twin forced- and induced-draught fans of 51 and 122 H.P. and two 41-H.P. secondary air fans; three grit-arresting Cyclones (one or two of which are automatically cut out at light loads) take the gases from each i.d. fan at a full-load efficiency of 92 per cent.

Combustion control is on the Hagan automatic system, which is responsive to steam-range pressure and maintains the appropriate air-fuel ratio and balanced furnace draught. Panels by Geo. Kent house all instruments and controls, except those for the soot blowers. Eighteen Clyde automatic soot blowers have been provided per boiler with Brookhirst electrical control. Provision is also made for water lancing the superheater on load. Two Howden-Ljungström heaters (cleanable on load) pre-heat the combustion air to 300 deg F.

Ash and grit fall by the rear ash pit and water seals to a John Thompson 42-in submerged rubber-belt ash conveyor and is discharged by a skip hoist to a 6,000 cu ft tile-lined steel bunker. Coaling plant (75 tons per hr) has been supplied by the Mitchell Engineering Co. Power for each of the boilers is taken from a 500-kVA 6,600/400-V Metrovick transformer by means of Pyrotenax cable (carried out by the undertaking's staff) to a Brookhirst control board. Other cabling has been supplied by Crompton-Parkinson and B.I. Callender's. Mather & Platt & Foamite have each provided fire protection.

In order to provide both for the present extension and for obsolescence of the existing wooden cooling towers, a hyperbolic concrete tower, designed by Mouchel & Partners and built by the Mitchell Construction Co., has been installed; it has a capacity of 2·5 million gal per hr, and is supplied by two Sulzer pumps each of half that capacity. The tower is 294 ft high and 195 ft 6 in. in diameter at ground level and its cooling range is 15 deg F with air at 64·4 deg F and 75 per cent humidity. The 300 ft by 14 ft 6 in. stack to which the flue gases pass at 240 to 270 deg F is said to be the highest steel chimney in Britain.

Acknowledgments are due to Mr. D. Bellamy, general manager, and Mr. W. H. Dunkley, his deputy, in respect of the above information.

Mr. Shinwell on Development

Speaking at the subsequent luncheon, Mr. Shinwell, referring to the imminence of nationalization of electricity supply, said that electrical achievements in many areas had been striking but existing boundaries retarded progress. While not partial to nationalization merely for its own sake, he considered that it presented the only way to securing orderly development over the whole country. Although he fully appreciated what municipalities and companies had accomplished, he held that the peculiar difficulties attending rural electrification required larger supply units controlled by men free from parochial outlook. In the country as a whole 63 per cent of rural premises were connected up, but only 27 per cent of farm buildings were supplied, more than half of them for the farmhouses only.

Mr. Shinwell commended the bold policy of development by the Dumfriesshire County Council in its sparsely populated area which contained practically no industries; within sixteen years 75 per cent of the possible consumers had been supplied and a further 10 per cent could readily be connected. A vital factor had been that no capital charges were made for connection to the mains: others were simplicity of the tariff and the giving of good service and

advice. One dairy farmer (owning 50 cows) had electrified his farm, dairy and threshing and corn-grinding machines at an annual cost of £20—work that would have required the employment of two men.

It would be some time, the Minister continued, before cuts in supply, due to plant shortages as a result of the war, would be overcome. Domestic consumers could assist in avoiding interruptions by switching off, on request, water heaters and fires. Returning to the question of nationalization, he said that he realized that some who opposed it held that the present system was the best for the end in view. He urged these to give their active assistance in developing the industry under any form of ownership in the public interest.

Mr. Shinwell also referred to the subjects of tariff uniformity and voltage standardization.

The toast list also included the names of the following:—The Lord Mayor of Kingston-upon-Hull (Alderman I. Robinson, chairman of the Electricity Committee), Mr. V. A. Pask (C.E.B.), Mr. F. Lonsdale (G.E.C.), Captain J. B. Woodeson (Clarke, Chapman & Co., Ltd.), Mr. D. Bellamy, Alderman F. Holmes (deputy chairman, Electricity Committee) and Sir Cyril Hurcomb (chairman, Electricity Commission).

New Welsh Power Station

Carmarthen Bay Project

A POWER station with an ultimate capacity of 300,000 kW is to be built by the Llanelly & District Electric Supply Co., Ltd., at Burry Port, Carmarthenshire, in accordance with an agreement entered into with the Central Electricity Board. Detailed survey work and trial borings are already being made and construction of the station is expected to start early next year. The total estimated expenditure is £12,000,000.

The station (Carmarthen Bay) is considered to be the key to industrial development planned for S.W. Wales. It is to be built in three sections, the first of which will cost £5 million and is expected to be in commercial operation by the end of 1950. Balfour, Beatty & Co., Ltd., have been appointed consulting engineers and contractors for the construction of the power station, and Sir Percy Thomas, of Cardiff, is to advise on the architectural features.

The Llanelly Company, in an official statement, says that application for the consent of the Electricity Commissioners to establish the new station had been authorized. It is understood, the company adds, that the local authorities and the local interim development authorities for the district under the Town and Country Planning Acts are in favour of the scheme. The site, covering 220 acres, is considered to be admirably suited for a large modern power station, being in close proximity to the local coalfields and having ample water and railway facilities.

Central African Water Power

Proposed Inter-Territorial Commission

WE are informed by the Colonial Office that at the fourth meeting of the Central African Council held at Salisbury, Southern Rhodesia, in November a number of recommendations were made, among them being one for the establishment without delay of an Inter-Territorial Hydro-Electric Power Commission of two members each from Southern and Northern Rhodesia with wide investigatory powers, including the power to engage consultants and specialists.

The proposed Commission would study the possibilities of Kariba and Kafuo hydro-electric power projects and any other large sources of power available for joint development and make recommendations thereon. It would consider load development in participating territories; the extent of initial hydro-electric development desirable and the time by which it should be in operation; the site selected for initial development; transmission line details and routes; finance and costs; the form of control of the undertaking; subsequent investigations and development; and irrigation possibilities.

The Commission would also study the possibilities of economizing in manpower by mechanization and modern labour-saving machinery, having regard to the effects of the project on the African labour situation. It would be financed by block grants and would submit estimates of the cost of its work and investigations. Nyasaland would be kept fully informed of the Commission's work.

Menai Straits Tidal Scheme

A PRELIMINARY scheme designed to demonstrate the economic feasibility of generating electricity from the tides in the Menai Straits has been drawn up by Mr. F. O. Harber, the Bangor borough electrical engineer. The advantages claimed over other tidal schemes are that the Straits have a tidal range of unusual magnitude and, being open both ends, would lend themselves to the construction of a double basin having a dam at each end and one in the middle, which would allow of a regular output without expensive pumped storage.

The Menai Straits are 12 miles long (Belan Point to Bangor Pier) with an area of just over 8 sq miles at high-water level and a tidal range at Bangor of 21·1 ft h.w.s. and 12·2 ft h.w.n. which falls at Belan to 13·8 ft and 6·8 ft. The high-level reservoir would be filled at high tides and the low level one drained at low tide. The centre dam would carry the generating plant, which would have a possible electrical output twelve times that now required for the Bangor supply area, and the annual coal saving is estimated at 60,000 tons. The nearest selected station is at Runcorn and the nearest main grid substation at Creive, 75 miles away.

Fuel Situation

Industrial Cuts to be Made

ALTHOUGH there has recently been a slight improvement in coal output, consumption is rising at a higher rate and the shortage is expected to become worse unless the demand is drastically cut. Mr. Shinwell, Minister of Fuel and Power, in making this statement last week, also announced compulsory measures for keeping down coal consumption.

He said that although supplies to gas and electricity works (and certain other industrial undertakings) would not be reduced he was taking steps to prevent further increases in use. It was also proposed to make an Order requiring all concerns using more than a specified amount of coal to reduce their consumption by 2½ per cent in each of the four-weekly periods after December 30th as compared with the four-weekly period immediately preceding a meter reading made early in December. Due regard would be paid to undertakings whose arrangements would not permit of a reduction. Mr. Shinwell suggested that all industrial concerns should aim at a reduction of 5 per cent.

The Order would apply to undertakings (industrial and commercial) which had an annual consumption of more than 100 tons of coal, 130,000 kWh of electricity or 7,000 therms of gas.

No compulsory measures would be applied to domestic consumers, but Mr. Shinwell appealed to them to reduce their fuel consumption voluntarily to prevent dislocation of industry and unemployment.

Plastic Insulating Materials

ATTENTION is directed to the merits of "plastics" and their growing importance as electrical insulating substances by DR. ING. GUIDO E. HAEFELY in a paper submitted this week to the Installations Section of the Institution of Electrical Engineers.

An endeavour is made to explain in a simple manner the fundamental chemical structure of some typical materials, without describing their manufacture or properties, the intention being to stimulate a desire for deeper knowledge of them. To understand their dielectric properties it is essential to be familiar with the fundamental concepts of chemistry and physics in addition to electricity.

Not to take advantage of the newer materials, would be gross negligence; but great care needs to be exercised when choosing the suppliers. Many of these materials are being produced by relatively small firms which have not the facilities required for checking consistency and performance.

When suggesting how new substances could be utilized to advance old processes, the author selects a few examples from his specialized knowledge. For instance the statement that the cost of a 220-kV bushing type insulator is as much as that of building a five-roomed cottage, makes it seem worth while to attempt the making of large bushings by moulding them as a whole, together with metallic layers, so as to exclude all air and thereby avoid subsequent absorption of moisture. The author believes the time is not far off when plastic flexible sheet will take the place of treated paper in the winding of bushings.

So far as the "silicones" are concerned, it is perhaps not just a fortunate coincidence that this new class of resinoids followed so closely upon the commercializing of glass-fibre insulation, which has lacked a suitable impregnant to fulfil its claim to great heat resistance.

Unfortunately the silicone resins are not obtainable in this country and it is feared that their cost will remain extremely high for some time to come until cheaper manufacturing processes are evolved. Since their processing temperature is of the order of 300 deg C, prospective manufacturers must realize that they will require new plant and for that reason alone several years must elapse before these materials can become popular in the electrical industry generally.

Railway Lighting

A PAPER on railway lighting was presented by MESSRS. A. CUNNINGHAM and G. W. GOLDS at this week's meeting in London of the Illuminating Engineering Society. A statement of general requirements was followed by remarks on the selection of fittings, with special regard for their simplicity, quality of light being regarded as more important than the degree of illumination.

Special cases commented on included the lighting of locomotive inspection pits, the interiors of box wagons in goods sheds, and shunting yards. Reference was made to the tendency to minimize artificial lighting in signal cabins to assist "dark adaptation" of signalmen's eyes when observing train movements through the windows. A scale model was exhibited to indicate possible ways of more safely lighting stairways, pointing out the need for contrast between the front edge and back of the treads.

Some attempt to forecast future developments anticipated the use of fluorescent tubes for particular purposes rather than wholesale substitution for filament lamps. The clear revealing of railway station names was considered to be a primary necessity as well as better means of guiding and directing the travelling public.

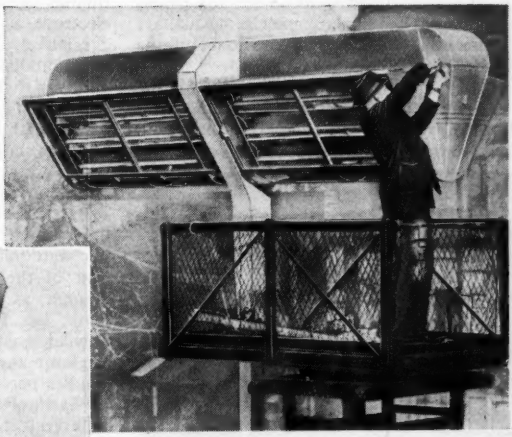
An Inter-Railway Lighting Committee had recently recommended the adoption of the I.E.S. Code as a general guide to the improvement of staff room amenities and welfare aspects.

Shopping-Centre Lighting

Fluorescent Installation in Brompton Road

CONTINUING its experimental work in connection with the use of fluorescent lamps for the illumination of shopping centres, Central London Electricity has now undertaken the responsibility for a second installation of the kind.

This new installation, in Brompton Road, S.W., carried out by the General Electric Co., Ltd., differs in several details from the earlier one in Old Bond Street, installed by the British Thomson-Houston Co., Ltd., which was described in the *Electrical Review* of September 20th. It comprises ten lanterns mounted at 30 ft on concrete columns—four on the outer kerbs and three with double lanterns on centre islands. These provide about 25,000 lumens per 100 ft for a 660-ft stretch of double carriage way near Harrods. Each lantern contains seven 80-W 5-ft fluorescent

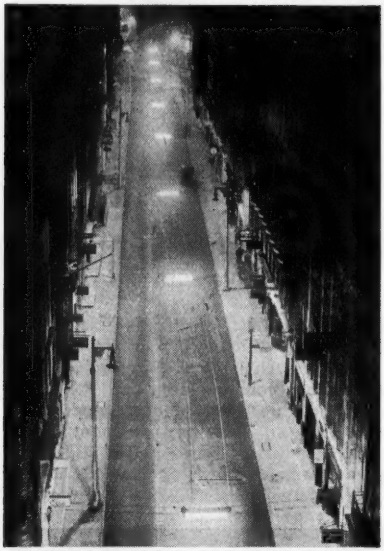


"Close-up" of double lantern

Day and night views of the standards and lanterns in Brompton Road

lamps in " V " formation and for an input of 630-W gives appreciably more light than 1,000-W tungsten lamps in the vicinity and usefully illuminates buildings and pavements as well. The lanterns are constructed almost entirely of light alloys and are glazed with sliding " Perspex " panels. Auxiliary equipment is contained in the bases of the columns.

In Brompton Road the lamps are of the " daylight " type, and an opportunity was afforded us recently of comparing them with the " warm-white " colour adopted in Old



Old Bond Street installation using catenary-suspended " Warm-White " tubes

Bond Street where the fittings and mounting method are also on other lines. In the latter case eight lanterns are suspended centrally over the roadway from catenaries slung across the street and can be drawn in to the kerb for maintenance.

The lanterns, each containing three 80-W 5-ft fluorescent lamps, mounted at a height of 25 ft give controlled cut-off distribution and contain all the auxiliary gear. They are spread at 80-ft intervals to give an output of 8,550 lumens per 100 ft. The total energy consumption of the installation is 2,400 Wh per hr, compared with 2,250 of the " economy " tungsten lighting it superseded and 3,750 of the pre-war installation.

Fluorescent lighting was chosen for the present tests because of the greater suitability of the natural colour of its light to the purpose in view as compared with the high-pressure mercury-vapour discharge lamp. The fluorescent lamp, consisting essentially of a tubular glass envelope with a filament electrode sealed in at each end, works at a relatively low gas pressure and although its luminous efficiency at the arc is not so good as that of the high-pressure lamp, the ultra-violet rays emitted are of shorter wave-length and cause fluorescence of certain powders coating the inside of the tube, which act as " frequency converters " which change invisible into visible rays.

By this means the overall efficiency of the light source is raised to as much as 25 lumens per watt initially. Since more than 90 per cent of the light comes not from the gas column, as in the case of the high-pressure lamp, but from the extended area of the powder coating, the surface brightness of the lamp at any point does not exceed 4 to 5 candles per sq in. The consequent absence of harmful glare gives improved visibility, thus contributing to greater safety in the streets. Central London Electricity, in co-operation with the manufacturers, intends to carry out further tests on these provisional installations during the coming winter.

French Electricity Restrictions

From Our Paris Correspondent

THE new plan for electricity restrictions in France has begun, and from 7 a.m. to 7 p.m. consumers are to be deprived of electricity on two days a week, except for a short period at mid-day for cooking purposes. Heavy penalties will be inflicted in cases where the authorized allowance is exceeded, and after the first fine the supply may be cut off entirely. A reduction of about 20 per cent in the present allowance is envisaged. Employers are still discussing the effect the cuts are likely to have on industry, and it is possible the working week will have to be reduced to four days. Illuminated signs are again strictly forbidden except on certain days to be specified as fête days.

Easing of the restrictions is dependent upon rainfall. Coal reserves in steam plants amount to 18 days' supply, which is considered satisfactory, but the hydro-electric reservoirs are only half full; that of the Massif Central is only 28 per cent full. The present deficit is about 400,000 kWh daily. It is hoped that if the weather is not too cold for some weeks it may be possible to reduce restrictions to one day.

Official prognostications for the future envisage cuts each year until 1950, when sufficient hydro-electric power will be available.

COMMERCE and INDUSTRY

Census of Production. Electrical Employment Statistics.

THE text was published last week (Stationery Office, 3d.) of the Statistics of Trade Bill introduced into the House of Commons by the President of the Board of Trade. The Bill provides for the taking of a Census of Production in 1948 and in every subsequent year and a census of distribution and other services in any year prescribed by the Board of Trade. The Board is to present " as soon as practicable " reports on the censuses with a summary of statistics obtained, with separate statements relating to Wales and Scotland. A schedule to the Bill sets out the matters which may form the subject of the census as follows:—The nature of the undertaking (including its association with other undertakings) and the date of its acquisition; the persons employed or normally employed (including working proprietors), the nature of their employment, their remuneration and the hours worked; the output, sales, deliveries and services provided; the articles acquired or used, orders, stocks and work in progress; the outgoings and costs (including work given out to contractors, depreciation, rent, rates and taxes, other than taxes on profits) and capital expenditure; the receipts of and debts owed to the undertaking; the power used or generated; the fixed capital assets, the plant, including the acquisition and disposal of those assets and that plant, and the premises occupied.

The Board is given compulsory powers in the securing of this information and penalties are provided for non-compliance.

Northmet N.A.L.G.O. Branch

The first annual general meeting of the Northmet Branch of the National Association of Local Government Officers was held at Church House, Southgate, on November 27th, when approximately 600 members were present. Although the branch was formed as recently as March of this year it has now over 1,000 members and is one of the largest branches of N.A.L.G.O. Over 90 per cent of the clerical and sales staffs of the Northmet Power Co. and many of the technical staff are members of the branch. This was the first branch of N.A.L.G.O. formed from members of the staff of a public utility company following the amendment of the N.A.L.G.O. constitution to allow the admission of such staffs to membership. Among the officers elected for the ensuing year were Mr. C. Baron (Northmet House), chairman; Mr. C. W. Dale (Outside Department), secretary; and Mr. L. H. Middleton (Wembley), treasurer.

Electrical Wholesalers

From the Electrical Wholesalers' Federation, 5, Vicarage Road, Henley-on-Thames, we have received a new list of members arranged, as usual, in alphabetical and " topographical " order; there are 165 of them, many with several branches. In an introduction to the list it is stated that since its creation in 1914 the Federation has strictly maintained the principle that its members must be accredited wholesale distributors, with suitable premises, equipment and organization, carrying adequate stocks (commensurate with the needs of the district) and therefore in a position to render a proper and efficient service to the contracting and retailing side of the electrical industry.

Transport Nationalization

The four main-line railway companies and the Road Haulage Association have issued a pamphlet in which they call for a public inquiry before the Government's plans for the nationalization of transport are proceeded with. They maintain that the British railways have been managed with skill and economy. It is recognized that co-ordination of transport is essential but point out that they have already submitted a suitable scheme to the Government.

Employment in September

Statistics showing the number of people employed in the various branches of the electrical industry in September are published in the *Ministry of Labour Gazette* for November, from which we have extracted the figures shown in the accompanying table.

The number of unemployed in the electrical industry (Great Britain) at October 14th was as follows:— Electrical engineering, 2,453 (751

EMPLOYMENT DURING SEPTEMBER (THOUSANDS)

Branch	Males (14-65)			Females (14-60)			Total		
	Mid-1939	Mid-1945	Sept. 1946	Mid-1939	Mid-1945	Sept. 1946	Mid-1939	Mid-1945	Sept., 1946
Electrical engineering ..	105·9	106·1	105·6	28·0	69·7	52·5	133·9	175·8	158·1
Electrical wiring and contracting	38·9	32·0	48·0	2·8	5·5	5·2	41·7	37·5	53·2
Electrical apparatus, cables, etc.	116·4	112·2	127·9	79·5	167·7	130·2	195·9	279·9	258·1

females); electrical wiring and contracting, 1,188 (82 females); electric apparatus, cables, lamps, etc., 3,393 (1,450 females).

Guaranteed Week

An agreement has been reached between the Iron and Steel Trades Employers' Association and six trade unions (including the Electrical Trades Union) for the operation of a guaranteed week of not less than four days' full wages. Full payment will be made for reasonable alternative work if normal work is not available.

Lighting an Operating Theatre

Probably in no other situation can the characteristics of the fluorescent lamp—its cool burning, its wide distribution of light and its ability to produce high-intensity light without intense shadow—be more fully appreciated than in an operating theatre. A new G.E.C. fitting installed in the two operating theatres of Ancoats Hospital, Manchester, is 6ft long, 4 ft wide and 10 in. deep. Five "Osram" 80-W fluorescent lamps mounted in high-efficiency anodized aluminium reflectors

Fluorescent lighting in the operating theatre at Ancoats Hospital, Manchester

produce an intensity of 300-400 lumens per sq ft when the fitting is mounted 3 ft above the operating table.

An emergency lighting system also embodied consists of four 100-W lamps mounted in parabolic reflectors fitted with glass diffusing screens. This emergency system provides 175 lumens per sq ft and is connected to an independent power supply. The light distribution is such that the whole length of the table is evenly illuminated. Adjustment for height is not required and none is therefore provided, though provision is made for tilting the fitting in any direction. The change-over to fluorescent lighting was carried out by the hospital's resident engineers, Mr. J. Wibberley and Mr. E. Graham, without interference or break in the normal theatre schedule.

Welsh Industries Fair

Among the exhibitors at the Welsh Industries Fair, to be held at the Royal Horticultural Hall, Westminster, from January 1st to 7th, are the following:—South Wales Switchgear, Ltd. (h.v. switchgear, transformers, wash-boilers, cookers, immersion heaters and house-service panels); Santon, Ltd. (electric water heaters and rotary switches); Thorn Electrical Industries, Ltd. (lamps, irons and vacuum cleaners); and Fisher & Ludlow, Ltd. (flow-line conveyor).

Amsterdam Exhibition

We are informed by Mr. S. H. Hartog, 9, Radnor Lodge, Sussex Place, W.2, that he is arranging an All-British Fair at the Victoria Hotel, Amsterdam. Mr. Hartog says that he is receiving the full support of the Council of Industrial Design, organizers of the "Britain Can Make It" Exhibition — a "photo-montage" of which will be exhibited together with some of the articles of interest to Continental buyers.

New Rubber Material

What is described as a new form of natural rubber latex with a reversed electrical charge, which has been named "Positex," is the subject of an explanatory leaflet (No. 1) issued by the British Rubber Development Board. Two grades of this substance, one vulcanized and the other not, are commercially available as the result of research conducted by the Wool Industries Research Association in collaboration with the Rubber Growers' Association and the British Rubber Producers' Research Association.

Natural latex, like all living matter, is attacked by bacteria so preservatives must be added (usually ammonia) so causing the emulsified particles to be negatively charged. Conversion to a positively-charged colloidal state according to the process of Dr. C. M. Blow, enables particles of rubber to be deposited on textile fibres in an alkaline bath under much more correctly controllable conditions and also

simplifies drying. Apart from such production advantages, other effects of "Positex" processing are novel. For example, twisted yarn can be rendered "softer" to handle without reducing its tensile strength and wearing properties are improved, while "felts" can be prepared from non-felting fibres of cotton and jute without waterproofing them; they retain their air permeability because the rubber is not deposited as a film, but as discrete particles. This method of rubberizing does not impart elasticity, the treated product not being in any way analogous to rubber-covered thread yarns

Electrical Production

The November "Monthly Digest of Statistics" shows that the monthly production of electric motors in June last was valued at £1,017,000, against £1,119,000 in May and £1,064,000 in June last year. In September 483 arc-welding sets valued at £64,000 were produced against 475 (£91,000) in June, 1945. Resistance welders numbered 151 (£42,000) against 154 (£38,000) in June, 1945. September production of portable power tools was 7,536 (11,191 in June, 1945).

The average monthly production of electric fires in the second quarter of this year is given as 225,000 (199,900 for the home market), as compared with 25,500 (22,700 for the home market) in the corresponding period of 1945. Electric irons were produced at a monthly rate of 302,700 (241,700 home), against 40,400 (37,900); vacuum cleaners at the rate of 52,200 (42,900 home), against 6,400 (6,300); and kettles at the rate of 48,200 (37,200) against 11,400 (11,100).

Report on German Industry

On Monday last Sir Stafford Cripps, President of the Board of Trade, opened at the Board of Trade, London, the B.I.O.S. Exhibition illustrating how nearly 3,000 teams consisting of over 10,000 British and American investigators went about preparing reports on Germany's technical discoveries. Nearly 1,400 of these reports have been published covering all branches of industry. There are also some exhibits covering Germany's wartime advances in science, heavy industry, consumer goods and nutrition.

In opening the display, Sir Stafford said that up to date 1,400 reports on particular subjects, concerning the whole range of production had been published. Apart from 460,000 copies of these reports circulated to institutions of all kinds for reference by their members, another 490,000 copies had been sold to individuals. He emphasized the urgent need for our manufacturers and producers to make the fullest use of this new knowledge, and appealed particularly to the smaller firms who had not their own research departments to allow B.I.O.S. to help them to introduce the latest manufacturing methods and processes. The Information Section of B.I.O.S. was at 37, Bryanston Square, London, but any of the Regional Officers of the Board of Trade could tell manufacturers how best they could get the information they needed.

The exhibition remains open until December 19th and is limited to the trade. It will subsequently tour a number of areas in the provinces. Admission is by trade card.

Radio Receiver Specifications, 1945-46

In the review of this booklet in our last issue we omitted to state the price, which is 9d. (10d. including postage). The booklet is published by the Trader Publishing Co., Ltd., and distributed by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1.

"Thermovent" Heaters

Because of recent heavy demands and Board of Trade export obligations, E. K. Cole, Ltd., have just announced the temporary closing of its home order book for "Thermovent" heaters for the domestic market.

Trade Publications

British Thomson-Houston Co., Ltd., Bridle Path, Watford, Herts.—Illustrated folder (L.804/M) describing fluorescent street lighting in Old Bond Street, London, including type of fitting used, polar diagrams and method of suspension.

Metway Electrical Industries, Ltd., King Street, Brighton, 1, Sussex.—Illustrated and priced catalogue of steel conduit with fittings and accessories.

Diary

Thomas Bolton & Sons, Ltd., have sent us a neat pocket diary, bound in maroon leather. This contains useful data relating to copper conductors, bronze and cadmium-copper wire and brass. There are also a number of conversion tables and other useful information.

Trade Announcements

The Publicity Department of British Insulated Callender's Cables, Ltd., is now at 72-78, Fleet Street, London, E.C.4 (telephone: Central 5241; telegraphic address: Bicalbest, London).

Heyes & Co., Ltd., state that the address of their London office is 21, Fitzroy Square, W.1 (telephone: Euston 6722; telegrams: Heyesco, Phone, London).

From January 1st the address of Transmission Lines & Cables Construction Co., will be Street Head, Newbiggin, near Aysgarth, Yorks.

Smart & Brown (Engineers), Ltd., have removed to Trading Estate, Spennymoor, Co. Durham.

Belling & Co., Ltd., state that they have inadvertently applied the name "Crescent" to some of their fires. They now find that this is the registered trade mark of Mitchell Electric, Ltd., and are taking steps to alter the name of their fires.

PARLIAMENTARY NEWS

By Our Special Reporter

LAST week in the House of Commons, Sir Wavell Wakefield asked the Minister of Transport what steps had been taken to provide crews of trains and those controlling train movements with modern wireless communication equipment.

Mr. Barnes replied that the possibilities of wireless communication had been the subject of experiment by the railways for some months past. Certain difficulties required to be overcome and when the necessary equipment became available, the tests would be continued.

Steel Shortages

Col. Stoddart-Scott asked the Minister of Supply what amount of steel would be produced in this country in the first quarter of 1947, how much would be exported, and how much would the supply fall short of the needs of British industry.

Mr. Wilmot said that provided transport and fuel were available about 2,300,000 tons of finished steel (the approximate equivalent of 3,300,000 ingot tons) should be produced. About 250,000 tons of finished steel might be exported. After allowing for imports, supply would probably fall short of estimated demand by about 500,000 tons.

Mr. Warbey asked the Minister of Supply what steps he was taking to stimulate an increase in the output of sheet steel above the present level of 80 per cent of capacity.

Mr. Wilmot said that until the proposed new continuous strip mill came into operation, the problem of increasing sheet steel production was primarily one of attracting more labour to the older handsheet mills which were concentrated during the war. Production from the two existing continuous strip mills was already very near its maximum, but efforts were being made to increase it.

Colliery Equipment

On December 4th, Mr. D. J. Williams asked the Minister of Fuel and Power if he was aware that inability to obtain mechanical and electrical equipment was holding up development in many South Wales collieries; and what progress was being made in making such equipment available.

Mr. Shinwell said that there was general difficulty in obtaining supplies of mechanical and electrical equipment, and arrangements had been made between the Departments concerned with a view to ensuring that colliery requirements received appropriate priority. In respect of many items the position had improved in recent months, but electric motors and iron and steel continued to present difficulties which, of course, were not confined to the mining industry. He was not aware of any special difficulties in South Wales, and collieries which were experiencing delays should communicate with his Regional Mining Supplies Officers.

Supplies by Submarine Cable

Asked by Mr. Thornton-Kemsley if he was considering the possibility of importing supplies of electricity by submarine cable connecting Norway with the North-East of Scotland; and what saving of British coal could be achieved if none were required for the production of electricity in the United Kingdom, Mr. Shinwell replied in the negative.

Machinery from Cardiff

Mr. G. Thomas asked the President of the Board of Trade if he would state the value of electrical machinery exported from Cardiff during the past six months.

Mr. Marquand said that the value of electrical machinery exported from Cardiff during the six months, May to October, 1946, was £148,000.

Load Reductions

Maj. Peter Roberts asked the Minister of Fuel and Power if he was aware that the Central Electricity Board in September, 1946, issued a notification to the public to the effect that an occasional reduction of the electricity load was caused by regular loss of about 300,000 kW, due to inferior quality fuel delivered to power stations feeding the grid; and what action he was taking to improve the quality of fuel to overcome this difficulty.

Mr. Shinwell said that owing to the great increase in the consumption of electricity and, in consequence, in the requirements of coal by electricity undertakings, it was inevitable that some of the fuel supplied should be of poorer quality than formerly. Every possible step was being taken to improve the preparation of coal but, apart from this, no immediate improvement in the quality of deliveries to electricity undertakings could be looked for.

Supply of Switches

Mr. G. Thomas asked the Minister of Works if he was aware of the difficulty in obtaining 15-A switch plugs, main d.p. switch fuses and wood blocks for fixing 5-A switches, in Cardiff; and what steps he was taking to increase the supply.

Mr. Tomlinson said he was aware of a general shortage of these electrical components throughout the country, and he had taken steps to ensure that the most urgent requirements, both in Cardiff and elsewhere, were met with the least possible delay. The Minister of Supply was doing his utmost to increase production.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

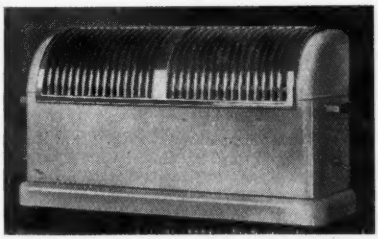
Domestic Wash-boilers

THE range of wash-boilers for household laundry purposes listed by AMPLEC, LTD., Grange Works, Accrington, Lancs, includes 7·5 and 10-gallon models, cream or mottled grey enamelled or galvanized. Three round models have lift-off lids, another is hinged, while the rectangular type has a flat table top with the rear legs on castors for mobility when tilted. Each has a chrome-plated drain tap and three-heat control by two switches, which are well recessed. The flat heating elements are formed of nickel-chrome ribbon on mica and copper sheathed. One model is of 2·5 kW, the others being of 3 kW and higher loadings can be arranged at extra cost.

Streamlined Convectors

Three models of the "Rowe" streamlined electric convectors are now available. Model RV1, a 1½-kW unit, is 24½ in. high by 15 in. wide; model RL2 (2-kW) 12½ in. high by 25 in. wide; and model RV2 (3-kW) 24½ in. high by 25 in. wide. All types are 8 in. deep and are provided with kick-switches to cut out half the elements. The latter are of the woven mat type, operating at black heat and mounted in banks.

A stove enamel cream finish is used for the sheet metal body, the grille and side handles



2-kW Rowe convector

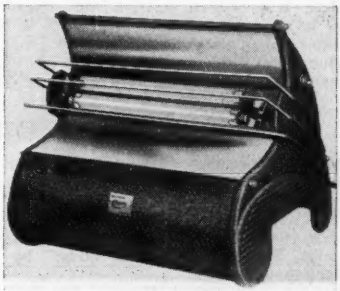
being chromium-plated. The grille is illuminated by a concealed red lamp. The makers, ROWE BROS. & CO., LTD., Pall Mall, Liverpool, have operated an electrical wholesale department for about thirty years; the introduction of these units marks their entry into the electrical manufacturing field.

Fastening Device

The neat "Fairey" fastener employed for securing aircraft cowling is now being offered for such general use as on the doors of domestic cookers, refrigerators, washing machines, heaters, instrument cases and tool boxes. The toggle action ensures positive locking and the clamping movement is adjustable. The spring action assists, but is not essential to, closure and also keeps the fastener open when disengaged; it closes flush, irrespective of the thickness of the panel in which it is inset, and will withstand 250 lb in both tension and shear. It is made by the FAIREY AVIATION CO., LTD., Hayes, Middx., and 24, Bruton Street, London, W.1.

Enclosed-element Fire

One of the household fires being made by CLAYTON, LEWIS & MILLER, LTD., Minerva Road, Southend-on-Sea, Essex, has been named



"Classic" radiator with elements inside silicon tubes

"Classic" and differs from the conventional in that the two elements, of 1 kW each, are enclosed in silicon tubes. A switch on the right-hand side controls one element only. The reflector is parabolic, plated and polished. The side brackets are cast aluminium, crinkle enamelled in various colours and a small bakelite carrying handle is fitted at the back.

Direct-reading pH Meter

What is claimed to be the only direct reading pH meter available in this country is announced by MUIRHEAD & CO., LTD., Elmers End, Beckenham, Kent. It indicates the acidity, or alkalinity, of liquid solutions by measuring the potential difference between appropriate glass electrodes immersed in the sample to be tested.

The instrument is 12·5 in. high, 13 in. wide, 11·5 in. deep and weighs 22·5 lb and is based on a constant-grid-current electrometer circuit (due to R. H. Thorp) utilizing a pentode valve as a d.c. amplifier. The grid-potential/anode-current graph is linear while the anode current is directly proportional to the applied e.m.f. for external impedance up to at least 300 megohms

Thus the pointer of a backed-off meter in the anode circuit will move over the scale in direct proportion to negative changes in e.m.f. applied to the grid from the electrode system. The scale may be checked by a calibrating potential produced within the instrument and itself checked with the aid of the indicating meter. Two scale points can then be adjusted to correspond with the values of two buffer solutions, which standardization will be maintained throughout a whole working day.

The meter is a.c. mains energized and the anode voltage is stabilized. It is intrinsically a millivoltmeter of variable sensitivity and may be used in that sense by setting the pointer to indicate 50 mV/pH, which means that 750 mV will be the maximum readable input.

Breakfast Cooker

The breakfast cooker known as the "Ireco" is made by the IRLAM ENGINEERING CO. (1942), LTD., Albion Works, Cadishead, near Manchester. It is 7·5 in. high, 16 in. wide and 10 in. deep, being constructed of sheet steel with a cast iron boiling plate measuring 9 by 6·5 in. and an aluminium deflector plate underneath. The griller compartment is 9 in. deep by 9·37 in. long by 5·75 in. wide, with grill-pan runners designed for five positions and a drop-type door fitted with a ball-catch and chrome-plated handle. A pressed steel splash-plate 10·75 in. high at the back is retained by two easily-removable screws. The loading is 1,750 W, for a.c. only as a "Simmerstat" energy regulator is fitted as well as a pilot lamp. The top of the cooker is chrome-plated and the body enamelled in pastel shades.

Insecticide Disseminator

A device known as the "Aerovap," which is claimed to abate the nuisance caused by flies, gnats and similar household pests, is obtainable from SHEPHERD'S AEROSOLS, LTD., 1, Old Burlington Street, London, W.1. A small arm bracket is screwed to the wall near a socket outlet, so that the plug can be connected to the head of the arm, which encloses a thermostatically controlled heater and cup containing an insecticide (DDT Geigy) which is volatilized into the atmosphere of the room. The loading is less than 60 W and it need only be switched on during the night. Three refill cups are said to be sufficient for four months' continuous operation.

Forthcoming Events

Monday, December 16th.—CARDIFF.—I.E.E. Western Centre (Installations Group). Informal dinner.

MANCHESTER.—Engineers' Club, Albert Square, 6.45 p.m. I.E.E. North-Western Students' Section. "Motion Study," by H. G. McKenzie.

BIRMINGHAM.—Grand Hotel. Birmingham Electric Club. "Lightning and its Effects," by Dr. T. E. Allibone.

Tuesday, December 17th.—LONDON.—E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6.15 p.m. Association of Supervising Electrical Engineers. "Mercury Arc Rectifiers, with particular reference to the Application of Variable-Speed Control of D.C. Motors," by F. T. Cowley.

MANCHESTER.—Engineers' Club, Albert Square, 6 p.m. I.E.E. North-Western Centre (Measurements Group). Informal discussion on "The Cathode Ray Oscillograph as a Universal Test Instrument," opened by E. C. Cherry.

Wednesday, December 18th.—LONDON.—I.E.E. London Students' Section, 2.30 p.m. Visit to the works of J. & E. Hall, Ltd., Dartford.

E.L.M.A. Lighting Service Bureau, W.C.2, 7 p.m. Electrical Power Engineers' Association (London Local Group). "The Effect of Welding Loads on Distribution Networks," by A. Haddock.

Royal Society of Arts, John Adam Street, W.C.2, 6.30 p.m. The Engineers' Guild. Discussion on "The Education of Engineers," opened by Professor C. L. Fortescue.

EDINBURGH.—Heriot-Watt College, 6 p.m. I.E.E. Scottish Centre. "Naval Fire-Control Radar," by J. F. Coales, H. C. Calpine and D. S. Watson.

Electricity Department Showrooms, 127, George Street, 7.30 p.m. Edinburgh Electrical Society. "Electrical Practice in Shipyards, with special reference to the Electrical Installation on board the *Queen Mary*," by T. S. Wood.

MANCHESTER.—Engineers' Club, Albert Square, 7.30 p.m. Association of Supervising Electrical Engineers (Manchester Branch). "Plastics and Engineering," by C. Wallace.

Thursday, December 19th.—LONDON.—Institution of Electrical Engineers, 5.30 p.m. "The Future of Pulverized-Coal Firing in Great Britain," by C. H. Sparks. (Joint meeting with the Institution of Mechanical Engineers.)

Alliance Hall, 2.30 p.m. Diesel Engine Users' Association. Annual general meeting. "Report on Heavy-Oil Engine Working Costs 1944-45."

Friday, December 20th.—LONDON.—Storey's Gate, S.W.1, 5.30 p.m. Institution of Mechanical Engineers. "Progress in Turbine Gear Manufacture in Recent Years," by A. Sykes, and "The Measurement of Errors in Gears for Turbine Reduction Drives," by C. Timms.

St. Stephen's Tavern, Bridge Street, Westminster, 6.30 p.m. E.P.E.A. Meter Engineers' Group (Southern Division). Discussion on speeding up testing and repair of electricity meters, to be opened by R. Thompstone.

Transformer Oil

Characteristics and Acidity Development Tests

By G. V. Harrap,
A.M.I.E.E., M.Am.I.E.E.

THE origin of crude mineral petroleum from which transformer oils are almost exclusively refined is obscure. The theory probably most nearly correct is that enunciated by Pontonie, viz., slime produced in stagnant waters is the first stage in the formation of mineral oil. This slime is produced from elementary animal and vegetable life, the remains of which putrefy and do not rot, due to the lack of oxygen in deep waters. During putrefaction the non-fatty constituents (albumens and cellulose) disappear. A grey, green purulent slime is then deposited, which is buried under subsequent deposits and forms a polymerous bitumen (bitumen and shale and boghead coal), which decomposes under the influence of pressure and heat to produce petroleum. A further stage in the metamorphism results in the oxidation and polymerization of petroleum to produce natural asphalts.

The above theory may be described as the organic explanation—the inorganic explanation was originally put forward by Mendelejeff. This assumes that metallic carbides (formed by the action of carbon with iron and other metals) have been decomposed under water at very high pressures and temperatures, resulting in the production of hydrocarbons. A subsequent rearrangement in the molecules of these hydrocarbons has been shown by various experimenters to be capable of producing hydrocarbons homologous to those found in petroleum. But this theory is not compatible with the optical activity of mineral oils.

The crude petroleums vary a good deal and those from Pennsylvania are chiefly paraffinoid hydrocarbons and homologous substances with certain smaller amounts of benzol hydrocarbons (cyclic compounds), whereas certain Russian oils are chiefly cyclic compounds such as naphthenes (Cn H_2n, cyclo-paraffin, which is derived from cyclopentane) and aromatic hydrocarbons of the composition Cn H_2n-6.

Crude petroleum is used as a fuel in many industries, and a great deal is purified or refined. The crude petroleum is placed in a retort and the temperature gradually raised. At first the lighter substances are volatized and condensed in suitable receivers. The receivers are changed when the specific gravity of the distillate has attained a certain value or when the temperature of the retort has risen sufficiently high. The chief functions are given in the accompanying table.

The residue in the retort is transferred to

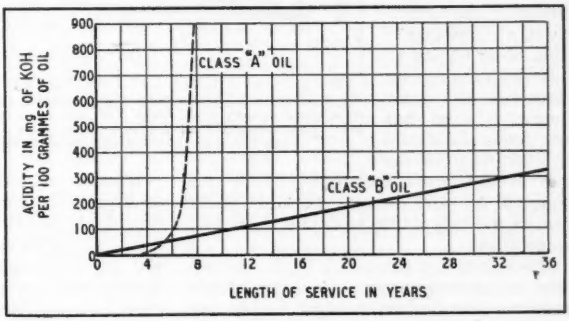


Fig. 1.—Increase in acidity with years of service for Class "A" and Class "B" oils

Fraction	*Chief Contents*	*Approximate Boiling Point Deg. C.*	*Uses*
Cymogene	C_4 H_{10}	About 0	Artificial cold
Phigolene	C_5 H_{10} to C_5 H_{12}	16	Local anæsthetic by freezing
Petroleum ether	C_5 H_{12} to C_6 H_{14}	50–60	Solvent fuel
Gasoline-petrol	C_6 H_{14} to C_7 H_{16}	70–90	Ditto
Ligroin (naphtha)	C_7 H_{16} to C_8 H_{18}	90–120	Ditto
Benzine (not benzene) benzoline	C_8 H_{18} to C_9 H_{20}	110–140	Ditto (substitute paint)
Kerosene - photogene paraffin oil	C_9 H_{20} to C_{17} H_{36}	150–300	Fuel and illumination

another still and further heated to a high temperature. It furnishes lubricating oils, vaseline (C_{19} H_{40} to C_{21} H_{44}) and paraffin (C_{21} H_{44} to C_{32} H_{66}), melting between 45 and 76 deg C, used for candles and insulating oil.

The author has compiled some test results that indicate the progressive development of acidity. Fig. 1 shows acidity in milligrammes of KOH per 100 grammes of oil plotted against length of service. No data are available upon the operating conditions for these transformers, but the oil did not operate at high temperatures, a representative value being 60 deg C. A curve for the average increase in acidity for Class "B" oil has been drawn and should be interpreted in the light of the above comments, but would appear to be valid for old-type oil in transformers working under moderate loads and temperatures.

The values for Class "A" oil are not quite so representative, since they relate mostly to transformers in which acidity was suspected. The curve of average increase in acidity for this class of oil, therefore, relates only to oils that have started to develop a considerable amount of acidity. These transformers were of modern construction, supplied since 1930, and were of weather-proof type with close-fitting lids and no breathers; all cable entries had wiped glands with lead-covered cable. Their size varied from 50 to 500 kVA, and the oil was all supplied by one maker.

The transformers filled with Class "B" oil, purchased between 1930 and 1940, were of the same type, but those with 20 to 35 years' service had wooden bushes for the cable entry. All transformers were installed in a building with three brick walls and a pair of mesh doors on the fourth side. It is noteworthy that high acidity has been rarely found in Class "B" oils and, in the three or four cases discovered, such high acidity only developed after about 33 years' service.

For this reason, this class of oil has been used to replace Class "A" oil which has developed high acidity, and its behaviour in transformers after refilling is shown in Fig. 2.

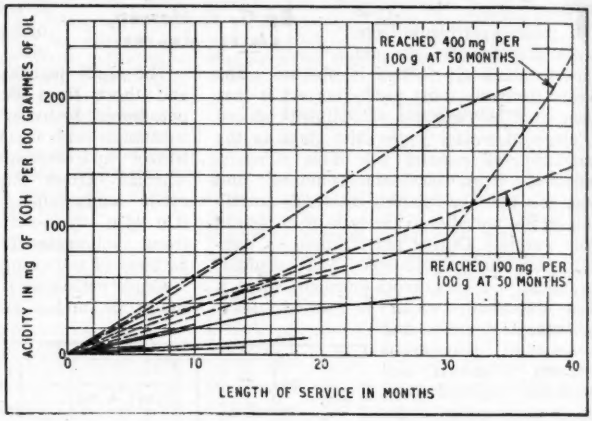


Fig. 2.—Relationship of acidity and time for transformers which, after having developed acidity with Class "A" oil, have been refilled with Class "B" oil. (The broken lines are for transformers without breathers and the full lines for transformers with breathers fitted after refilling.)

When a transformer oil developed high acidity, the core and windings were thoroughly washed with new clean Class "B" oil. This was applied under pressure and the whole core, frame and coils were washed and brushed and all oil ducts cleaned as well as possible. The tank, including all tubes, was thoroughly brushed and washed down and then refilled with Class "B" oil. When the transformer was again put into service, oil tests were taken at approximately six-month intervals. It was found that even with the thorough cleaning described above, and the use of the slower acid-developing oil, i.e., Class "B," when once a transformer has developed acidity, the new oil quickly reaches high values, and it would appear from Fig. 2 that, after about three years, the process of cleaning, etc., must be repeated. It is of particular interest that for all the transformers concerned, the rate of production of acidity is approximately the same, and would appear to be at the rate of about 0·4 mg of KOH per gramme of oil per annum, although towards the end of the three years the increase is more rapid.

In an effort to determine whether dielectric strength of the oil suffered any deterioration with increase of acidity, tests were taken on

certain samples. The results obtained show that there is no relationship between the two values, dielectric strength being influenced more by moisture content and sludge than by acid.

The value of " breathing " is shown in the results obtained when transformers that developed acidity with a grade " A " oil and were refilled with grade " B " had breathers attached before being put into service again.

Production Engineering Research

New Association's Plans

EARLY in 1945 the Institution of Production Engineers, the Machine Tool Trades Association, the Gauge and Tool Makers' Association and the National Federation of Engineers' Tool Manufacturers set up a Committee to consider the establishment of a research association. As an outcome of this Committee's work the Production Engineering Research Association of Great Britain (PERA) was incorporated on June 13th this year, and in July took over the staff, equipment and other assets of the Research Department (formed in January, 1939) of the Institution of Production Engineers. On December 3rd a reception was held at the Savoy Hotel, London, at which the objects of the Association were explained and some particulars were given of its plans for future activities.

Mr. F. W. Halliwell, chairman of the Council, in introducing Mr. John Wilmot, Minister of Supply, stated that Lord Riverdale, chairman of the Advisory Council of the Department of Scientific and Industrial Research, had accepted the presidency of the Association. Mr. Wilmot said that the Association was sponsored by the D.S.I.R. and was intended to improve industrial efficiency. It was a combination of those who made machine tools and those who used them, and was a project for improving the high standard of precision engineering.

Sir William A. Stanier, past president of the Institution of Mechanical Engineers, said that much good work had been done by individual firms, but there were so many problems to be solved and so much exploratory work to be done that no one firm could undertake such a task. The establishment of the Association did not mean that manufacturers were exempt from the need to press on with their own individual research and development; the two sets of research should be complementary.

Mr. M. H. Taylor, a member of the Council, after tracing the events which led to the formation of the Association, said that it had acquired Staveley Lodge, Melton Mowbray, which was being converted into administrative headquarters, while outbuildings were being converted into workshops of 10,000 sq ft. There was at present a staff of thirty assistants, under the director, Dr. D. F. Galloway, and it was the immediate aim to increase this staff to fifty. Provided the industry could raise £15,000, the D.S.I.R. would provide another £15,000 and above this figure the D.S.I.R. would give pound for pound up to a maximum D.S.I.R. contribution of £35,000 a year.

Observing that the ultimate aim was not research results themselves but the practical application of those results to industry, Dr. Galloway said that the main tasks of PERA were to identify the real problems of production engineering, find their solution, and weave the improved methods into the fabric of production practice. As the volume of their results grew they would present available data in a form which could easily be used; in reports, books, instruction manuals; through lectures, demonstrations, and sometimes by special courses of instruction, so as to ensure that these results reached the men who had to use them in a form which they could understand and apply. These means of disseminating information would be augmented by the continuous liaison between PERA and its individual members through frequent visits from mobile investigators on the field research staff. The success of the Association demanded that the application of research results in industry should not only be full and effective—it must be prompt. The time lag between research and the application of results must be reduced to the minimum in order that British production engineering might derive maximum benefits from the research carried out and in order that the nation as a whole might derive greater true wealth from our available resources of labour and raw materials.

I.E.E. Centre Activities

THE Western Centre of the Institution of Electrical Engineers has decided to revive the pre-war summer meeting and accommodation has been booked at the Carlyon Bay Hotel, St. Austell, Cornwall, for the week-end June 6th-9th, 1947. The inclusive hotel charge is not expected to exceed £5 per head. Members wishing to attend should notify Mr. L. Burdes, hon. secretary of the Western Centre, Institution of Electrical Engineers, Dorset House, Clifton, Bristol, 8, not later than January 31st, 1947.

The Council of the Institution of Electrical Engineers has authorized the enlargement of the area of the Dundee Sub-Centre to include the counties of Aberdeen and Kincardine. The name of the Sub-Centre has been changed to " North-East Scotland Sub-Centre."

NEW BOOKS

Results of Rubber Research. A.C. Manual for Students.

Rubber in Engineering. Services Rubber Investigations Panel. Pp. 268 and xviii; figs. 87. Stationery Office, Kingsway, London W.C.2. Price 10s.

The original edition of this publication, which was produced about fifteen months ago for circulation among Service Departments, rubber manufacturers and large users, has now been exhausted.

In order to meet a continuing demand, it has now been reissued very slightly revised and with an extended bibliography for sale to the general (mainly engineering) public, at a price that is small in relation to the information contained and lucidly presented. Much of the research on which its contents are based has been carried out by the Dye-stuffs Division of Imperial Chemical Industries, Ltd. The scope of the work covers underlying principles rather than workshop applications. Its direct electrical bearing is not immediately obvious, as the only item classified in the index as relating to this subject is "electrical conductivity," but in view of the importance of rubber as an insulant, many other parts of the book are likely to interest readers. Each of the book's sixteen chapters starts with a clear summary and concludes with a list of the sources of references made in the text.—C.O.B.

Questions and Answers on Alternating Current Work. By E. Molloy. Pp. 144; figs. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 5s.

This little book is a member of the "Q & A" manuals and the reviewer regrets to state that while the questions are asked they are in many cases not answered—and cannot be answered within the space allocation—in a manner satisfactory to the reader. Indeed, the text is so abbreviated that in some parts it is reduced almost to vanishing point with the result that the associated diagrams are rendered nugatory.

The work is divided into eleven sections covering simple a.c. theory, power generation and measurements, transformers, rectifiers and convertors, protective devices, lighting, motors, welding, a.c. heating, electronics and a.c. circuit calculations, and it is thus abundantly evident that the author has been seriously embarrassed by lack of space. He might have produced a far more useful work if he had kept a better sense of proportion. For example, it is questionable whether a book which opens with (very) "Simple A.C. Theory" should even attempt to give information concerning the construction and operation of such apparatus as tap-changing transformers, moving-coil and induction regulators, Schrage motors, mercury-arc rectifiers, the cyclotron and betatron and the cathode-ray tube and electron microscope.

Some details require tightening up: in Fig. 16, it would be better to label the three-phase voltage waves "AB, BC, CA"; in the caption to Fig. 20, neither "ring" nor "mesh" should be given as alternatives for "delta"; on page 31, the "Clark or Weston cell" appear to be given as legal alternatives, but the Clark cell is obsolete; in Fig. 26D, the wattmeter indicates the *total* three-phase power, and this is not made clear in the text; Fig. 28(b) does not give the usual arrangement of shell-type transformer, but the "Berry" type, the conventional shell construction does not provide better cooling than the core type, and thus the text below this figure is misleading; Figs. 47 to 49 would be improved by putting arrowheads above the current transformer windings indicating directions of induced voltage; in Fig. 51, the current values do not refer to fault conditions but to full-load conditions; in the text referring to Fig. 57 the words "phase splitting arrangement" should be replaced by "condenser for power factor improvement;" there is a dangerous statement at the bottom of page 121—when a series circuit is in resonance, it does not altogether "behave as if it contained only a pure resistance."—H. P. Y.

Elementary Vectors for Electrical Engineers. By G. W. Stubbings, B.Sc. (Lond.), F.Inst.P., A.M.I.E.E. Pp. 110; figs. 73. Sir Isaac Pitman & Sons Ltd., Parker House, Kingsway, W.C.2. Price 6s. 6d.

This is the second edition of a book which was recommended in the *Electrical Review* of May 24th, 1940, as likely to be useful to those with a rudimentary knowledge of geometry who desired a simple exposition of its subject. The opportunity has been taken in this re-issue to amplify the text with a view to classifying a few explanations and to extend the final chapter on hyperbolic functions.—C.O.B.

Books Received

The Principles of Technical Electricity. By M. Nelkon. Pp. 240; figs. and index. Blackie & Son, Ltd., 66, Chandos Place, London, W.C.2. Price 17s. 6d.

Engineering Radiography. "Mechanical World" Monographs. Pp. 57; figs. 37; illus. Emmott & Co., Ltd., 31, King Street, Manchester. Price 2s. 6d.

Alternating Current Practice. By C. H. Claude Cooke. Pp. 232; figs. 92; index. Crosby Lockwood & Son, Ltd., 20, Tudor Street, London, E.C.4. Price 15s.

An Introduction to Electronics. By Ralph G. Hudson. Pp. 97; figs. 72; illus.; index. The MacMillan Co., New York. Price 15s.

ELECTRICITY SUPPLY

Distribution Development Plans. Objection to Bankside Scheme.

Accrington.—HIGHER CHARGES APPROVED.—The Town Council on December 3rd approved a recommendation to increase the electricity charges. Opposing the increase, Councillor Tetlow said that before the war the electricity undertaking made £100,000 profit in five years. After six years of prosperity it had lost £3,000. A reduction in discount from 10 to 5 per cent would save £7,000, and they could postpone any advance until the end of the year. An increase of 33⅓ per cent would be a blow to those anxious to use electrical appliances in their homes.

APPOINTMENT OF CONSULTING ENGINEERS.—The Town Council is to appoint Kennedy & Donkin (London) as engineering consultants in the design, construction and commissioning of the new £5,000,000 power station at Huncoat. This is an alternative to a proposal to adopt a scheme prepared by the borough electrical engineer (Mr. A. Goward) under which he would have undertaken sole responsibility at a cost of £103,292, plus allowances to various officials and staff. The borough electrical engineer, to whom terms of remuneration were suggested, expressed inability to accept them.

Acton.—COOLING TOWERS.—The Corporation Health Committee reports that, arising out of representations, the London Power Co., has arranged to replace the wooden cooling towers at the Acton Lane generating station by concrete structures and to install ducting to conduct the emissions from the boilers to the gas washing tower.

Barrow-in-Furness.—RURAL DEVELOPMENT.—The Corporation Electricity Committee has approved an estimate of £11,900 for developments in the rural area.

Bedford.—SUPPLY TO VILLAGES.—The Rural District Council has decided to make representations to the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co., for the provision of electricity to the villages of North Bedfordshire which are still without a supply.

Bolton.—SHOWROOMS.—The Electricity Committee has appointed a sub-committee to consider the provision of showrooms for the Department.

Burnley.—PROPOSED NEW POWER STATION.—The suitability of a site near Barden Lane, Burnley, for the erection of a new generating station is to be investigated by the chairman of the Corporation Electricity Committee, the town clerk and borough electrical engineer.

Coventry.—PRIMARY SUBSTATION.—Application is being made by the Electricity Committee for sanction to borrow £123,796 for the erection of a primary substation in the Whitley area.

Fort William.—TRANSFER OF UNDERTAKING DISCUSSED.—After a private meeting of members of the Town Council and the North of Scotland Electricity Board, Mr. A. E. McColl, deputy chairman of the Board, stated that the main purpose was to explore the question of the transfer of the undertaking to the Board.

Great Yarmouth.—DISTRIBUTION SCHEMES.—The Electricity Department has received the Electricity Commissioners' consent to undertake the following works to the amounts stated and to raise loans for expenditure which is not covered by capital contributions:—New supplies to Lound Waterworks, farms, smallholdings, etc., in part of the rural area, with reinforcement of h.v. and l.v. supplies in the village of Blundeston (£21,583); augmented substation supplies to meet special development at two factories and to an industrial area (£10,470); reorganization of 6·6-kV distribution system, mainly replacement of existing h.v. switchgear and reinforcement of l.v. mains in the town area at specified points, including the establishment of three new substations (£36,000); relief of overloaded h.v. overhead lines and establishment of new substations and switching centres in connection with new housing schemes in town and rural area (£18,452); unspecified mains and services for twelve months (£15,000); and unspecified substation equipment for twelve months (£15,000). The total estimated expenditure is £116,505.

Huddersfield.—RECLASSIFICATION OF STATION.—As from January 1st, 1947, the classification of the St. Andrews Road generating station will be changed from Class G to Class H for the purpose of the N.J.B. Agreement, the capacity having been increased to 60,000 kW.

The Central Electricity Board has sent a letter of congratulation to the borough electrical engineer (Mr. F. A. Ellis) on the completion of the £500,000 extension at the power station. The letter states that it is the first of the 1946 programme to be brought into service in the Mid-East England Area.

Liverpool.—DEVELOPMENT PROJECTS.—Extentions and new works are to be carried out as follows:—Six additional 33-kV. transmission cables from Clarence Dock to new substations, £795,790; substation, Wellington Building, The Strand, £3,516; substation at Litherland, £8,789; dust removing plant, Clarence Dock power station, £1,767; supply to Huyton Hey, £4,976; supply to Patent Knitting Co., Knowsley, £5,630; and three substations, Gateacre, £3,279.

London.—OBJECTION TO BANKSIDE STATION EXTENSION. — The Southwark Works Committee expresses objection to the proposal of

the City of London Electric Lighting Co., Ltd., to extend the Bankside power station, on the ground that it will jeopardize the scheme for the redevelopment of the south bank of the Thames.

Luton.—ABOLITION OF METER RENTS AND SURCHARGES.—Consumers in the Corporation's area will benefit by £14,000 a year as a result of a decision to discontinue meter rents on standard charges and abolish the surcharges to Dunstable, Leighton Buzzard and Linslade consumers.

Manchester.—HOSPITAL IMPROVEMENTS.—The Health Committee is to renew the electrical installation at Baguley Sanatorium at a cost of £1,000; change over the supply at Booth Hall Hospital (£3,000); lay a new main cable (£3,000); provide a new lift and reconstruct existing lifts at Crumpsall Hospital (£4,500); improve electric lighting at Limbert Nurses' Home (£1,050); renew wiring at Langho Colony (£1,100) and provide a bed lift (£1,650) and extend cable (£825) at Monsall Hospital.

Mansfield.—INSTALLATION EXTENSIONS.—A number of tenants of prefabricated bungalows have extended their electrical installations to give a light in the outside coal house. The Housing Committee has decided to inform them that such extensions can only be sanctioned if carried out by a competent electrician, and that extensions not so carried out must be disconnected unless certified by the borough electrical engineer as in order.

Mountain Ash.—ANOTHER "CHRISTMAS BOX." —For the fourteenth successive year consumers are to receive a "Christmas box" in the form of special reduced tariffs in respect of the December quarter. This year, as in 1945, the lighting rate for the quarter will be ½d. per kWh up to 100 kWh, with additional consumption at 1d. per kWh, no meter rents to be charged. Under the two-part tariff the running charge will be reduced to ½d. The prices in each case are net, for prompt payment. Recommending these concessions at the last Council meeting, Councillor S. Blake (chairman of the Municipal Undertakings' Committee) paid a tribute to the electrical engineer and manager (Mr. E. W. Jones).

Peterborough. — EXTENSIONS. — Additional distribution main switchgear is to be installed at a cost of £19,820. High-voltage cable networks in the northern and southern parts of the city and the low-voltage network in the north of the city are to be reinforced at an estimated cost of £39,579.

Poplar. — NEW POWER STATION. — The Electricity Committee is to invite specialist firms to quote for civil engineering, constructional steelwork, coal-handling plant, jetty cranes and turbine-room travelling cranes for the new power station at Brunswick Wharf. The Electricity Commissioners have stipulated that the station shall be designed so as to permit the installation of plant for the prevention of the discharge of sulphur and its compounds.

Rotherham.—POWER STATION EXTENSIONS.—Application is being made for sanction to borrow £1,100,000 for extensions to the power station, to be completed in 1950.

SUPPLY TO ESTATES.—The Electricity Committee is to provide a supply to the Thorpe and Piccadilly housing estates at a cost of £6,260.

Scotland.—LOCH AFFRIC SCHEME.—The only objection lodged against the North of Scotland Hydro-Electric Board's constructional scheme in the Loch Affric-Fasnakyle-Mullardoch district has been withdrawn and the Secretary of State has not found it necessary to hold an inquiry. His Order confirming the scheme, together with details of the Hydro-Electric Board's plans, has been laid before Parliament.

Southwark.—ELECTRICITY FOR FLATS.—At a cost of £5,100 the Electricity Committee is to provide a supply to flats in the King Street and Rockingham Street areas.

Stockton-on-Tees.—MEMBERSHIP OF D.J.B.—After a full discussion, the Town Council has decided to rejoin the District Joint Board.

ADDITIONAL STAFF.—In view of important developments in the electricity undertaking, the general manager and engineer (Mr. N. Hunter) has reported to the Electricity Committee that it will be essential to increase the technical and administrative staff, and a sub-committee is to make recommendations.

RING MAIN EXTENSION.—It being now necessary to commence the proposed 11-kV ring main extension at Oxbridge at an estimated cost of £4,846, application is to be made to the Electricity Commissioners for the necessary sanction.

INDUSTRIAL ESTATE.—Contracts in connection with the Dog Hill Farm industrial site have been placed with A. Reyrolle & Co., Ltd., W. Lucy & Co., Ltd., C. A. Parsons & Co., Ltd., and Edison Swan Cables, Ltd.

Wallasey.—JUBILEE CELEBRATION.—The Electricity Committee is arranging for the celebration of the borough's electricity jubilee on January 29th. A brochure giving an account of the history and development of the electricity undertaking is being prepared.

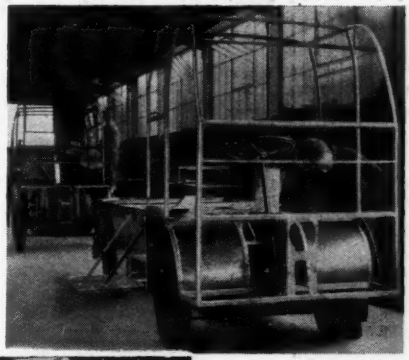
York.—DISTRICT HEATING.—The Housing Committee has arranged for the electrical engineer to investigate the question of district heating.

Yorkshire.—REDUCED POWER CHARGES.—Following the lead of the Yorkshire Electric Power Co., the Electrical Distribution of Yorkshire, Ltd., and the North Lincolnshire and Howdenshire Electricity Co. have decided to reduce the charges for electricity supplied under agreements including a coal clause. Nearly 300 industrial concerns, mostly in South Yorkshire and North Lincolnshire, will benefit. Details of the new scale of charges will be issued shortly.

Electric Vehicle Production

Modern Methods at a New Leicester Factory

AFTER having made shift in a number of separate small premises since their factory in Hastings Road, Leicester, was bombed, Cleco Electric Industries, Ltd., have just moved into a completely new factory in Foundry Square. With production again all under one roof the company hopes to be able to step up output considerably and, although scarcely settled in properly yet, is already turning out weekly about three electric vehicles, as well as a considerable quantity of chargers, welding equipments, etc.



Stages in production at the new Cleco electric vehicle factory

One side of the factory is devoted to the preparation of the various metal components of the vehicles —guillotining the sheet aluminium for the body panels; cutting, grinding and drilling chassis members, etc. and jigging the various components. Welding of the body frames, the installation of the motor and control gear and the addition of the body panels occupies the other side of the works, the centre portion being left for finishing-off processes.

Several modifications in design are incorporated in the post-war models with the object of improving both operational performance and servicing. For reversing, instead of a switch on the dashboard there is a lever at the side of the driver, close to the contactor gear. By fixing the ampere-hour meter at the back of the seat, the wiring has been greatly simplified. For first speed the pedal control puts in the motor with full resistance. Further depression gives the second speed by operating one mercury switch, two further mercury switches giving full speed. The interlocking of the brake with the toe pedal ensures that full power cannot be applied with the foot brake on. This feature facilitates starting uphill.

The use of a very short propeller shaft as incorporated in the Cleco pre-war private car chassis is now a standard feature of the electric van chassis. As a result of wartime experience a modern technique in body construction has been adopted for minimum weight coupled with maximum strength and durability — stressed aluminium panels on metal framework. A neat arrangement for holding the spare wheel in a compartment at the rear gives ready access without unscrewing. Almost every part is interchangeable and can be replaced from stock. Retractable batteries on roller bearings are standard. A charger specially designed for the vehicle is made in the same factory.

New E.A.W. Branch

ON November 28th the Bangor Branch of the Electrical Association for Women was formed (it had previously been a unit of North Wales Coast Branch). Councillor Mrs. Chamberlayne, a member of the Electricity Committee, is chairman and the hon. secretary is Mrs. Skeats. Those present at the meeting, over which the Mayor of Bangor presided, included the borough electrical engineer and his wife (Mr. and Mrs. F. O. Harber) and members of the E.A.W. North Wales and North Wales Coast Branches.

Heating-Element Shortage

Difficulties Which Confront the Manufacturers

AMONG the many scarce materials and components urgently required by electrical apparatus manufacturers, heating elements are still extremely difficult to obtain. Some of the reasons for this have been given to us by Mr. A. Behm, managing director of Wireohms, Ltd., Nottingham, which specializes in the production of these components. Peace found the company with all key operatives and the greater proportion of its 1939 employees, together with administrative officers, still in the Services. There was no available labour locally, but within a radius of forty miles a town had been found with a supply of "green" labour provided a works could be sited there. This meant acceptance of decentralization and its attendant problems.

In October, 1945, it was obvious that such materials as nickel-chrome wire and ribbon, mica, and refractories were very scarce and that the freedom with which licences had been granted for the manufacture of household electrical equipment had resulted in a larger number of firms seeking to share what little there was. The main trouble, however, was that in the case of the nickel-chrome wire and ribbon the industry was overloaded and suffering from a lack of all classes of labour and was still being drained of useful personnel for the Services without suitable substitution.

Refractory Position

The refractory industry was in an even more parlous state—it still is—in that the source of its labour supply had been drawn upon for essential war work, and workpeople showed no inclination to return to conditions which compared unfavourably with those they enjoyed during the war. Mica, the main source of which is India, was controlled and requirements for certain grades and qualities could not be met.

Committed to a progressive and expansionist policy the firm now had to keep a balance in labour and material with the latter as the controlling factor. The problem of how to improve material supply was one for the Board of Trade to solve. Experience has taught the company that to obtain action on the part of Departments within Ministries the "prod" must come from above, and this was done by raising a question in the House and at the same time circularizing every Government Department that would be stimulated into action, with a comprehensive and detailed report in support of the company's statement and claims. This action had the required effect though not the required results! The company did obtain permission to import from America its requirements of wire and ribbon, but the high initial cost, plus import duty, the conditions in the matter of currency imposed by the American manufacturer, the non-guarantee of regular delivery either because of lack of shipping or labour troubles, and the threat to a stable financial position from unbalanced home material supplies due to irregular delivery combined with E.P.T. demands, resulted in the decision not to purchase. In the light of subsequent events, i.e., American labour troubles and rising prices, the decision was most certainly a correct one.

Mica Supplies

About this period came the de-control of mica and with it the release of Indian merchants from American and British contracts, and an arrangement between Great Britain and India with regard to the disposal of the accumulated mica stocks. Since then there have been restricted supplies and continuously rising prices. The instability of this market and the conflicting interests operating in it will cause difficulty for some time to come.

With regard to refractories it was found that there were sources of supply outside the refractory industry, plentiful but high in price. In some cases the product was readily identifiable; no satisfactory explanation could be found, but it was quite obvious that no matter how innocent the manufacturers may have been their products were being diverted from long-established customers. The company has not purchased a single item from such a source nor will it. It was decided that any orders requiring a refractory should be accepted only if customers could supply that item. And they did!—in quantities and variety which on investigation disclosed that manufacturers hitherto not engaged on these lines had now turned their attention to what, judged by the prices, must be a very profitable side-line.

Despite all these difficulties, coupled with the necessity to train a new labour force, the company now employs 300, compared with ninety before the war.

Standard Dry Batteries

THE minimum rating on continuous discharge of primary cells of the type depolarized mainly by the free access of air has been prescribed in B.S.1335 : 1946. The specification describes the method of test on which the rating is based and also a system of nomenclature which enables the type and size of cell to be expressed by a sequence of two or three letters and a number. Details are included of the quality of materials to be used as well as the dimensions of electrodes, containers, connecting wires and terminals. The specification is obtainable for 2s. from the British Standards Institution, 28, Victoria Street, London, S.W.1.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Crompton Parkinson, Ltd.—We have now received a copy of the company's report and accounts, to which we briefly referred in our last issue. The trading profit for the year ended September 30th last, including dividends on investments, etc., was £468,328, as compared with £462,533 for the preceding year. From this is deducted depreciation, £25,000, and directors' fees, £2,965, leaving a net profit of £440,363 (against £434,283), which with £690,039 brought in makes £1,130,402 available. The final dividend on the ordinary and "A" ordinary stock is 7½ per cent actual, making 15 per cent for the year, and in addition a special cash bonus of 7½ per cent is paid on the ordinary and "A" ordinary, making a total distribution of 22½ per cent. The dividend and bonus are the same as for the previous year. The balance carried forward is £797,902.

In his statement which has been circulated with the report and accounts, Mr. A. Parkinson (chairman and joint managing director), refers with regret to the death of his brother, Mr. Frank Parkinson, who was chairman and joint managing director of the company, and to the changes which have been made in the board of directors.

Reviewing the company's activities during the year under review, Mr. Parkinson says that the reconversion of the factories from war to peace is almost complete, but they are still engaged in replacing equipment which has become obsolete and in expanding the production capacity to meet an increasing demand for their products. The company has sold the lease of the Gaiety Theatre, which was purchased in 1939 with the object of securing permanent premises in London by the erection of a modern commercial building, and has taken other steps to secure London accommodation. Mr. Parkinson refers to the partnership entered into with the Austin Motor Co., Ltd., for the development of the electric vehicle and electric industrial truck side of its business.

Since the termination of hostilities in Europe and the Far East, the company has been actively engaged in the re-establishment of old contacts and the opening up of new avenues of trade in overseas markets. These activities have been seriously hindered by their inability to supply their products to meet more than a fraction of the combined home and overseas demand. Their factories overseas are meeting with the same problems as assail the company in England. In Australia they have embarked on the reorganization and extension of their manufacturing facilities and have secured a substantial financial interest in Noyes Bros. (Sydney), Ltd. The company is actively planning an extension of manufacture in India, and in New Zealand the new factory is nearing completion, production plant and equipment are being installed and production for the training of operatives has commenced. In addition the company is partner with other British manufacturers in similar enterprises in Australia, Canada, New Zealand, South Africa and India. The past year has seen an expansion of both the size and scope of these operations.

The Lightfoot Refrigeration Co., Ltd., has declared an interim ordinary dividend of 3 per cent (no interim payment was made last year). It is stated that output during the last four months of the year will be substantially reduced as a result of the destruction of materials by fire in the factory at Wembley in September.

African Cables, Ltd.—In connection with plans for extending and modernizing the company's factory, resolutions were passed at the annual meeting held recently in Johannesburg authorizing an increase of capital from £260,000 to £390,000 and the capitalization of £130,000 of the reserves by the issue of bonus shares to shareholders.

Aeronautical and General Instruments, Ltd.—At the annual meeting a resolution was passed authorizing an increase in the capital of the company to £400,000 by the creation of 150,000 shares of £1 and 400,000 shares of 5s. The chairman (Mr. W. McClelland) said that it was their desire to turn to commercial account the extensive experimental and design work which had been undertaken.

Turner & Newall, Ltd., are maintaining the dividend on the ordinary stock at 12½ per cent by a final payment of 8¾ per cent. A preliminary statement for the year to September 30th gives the net profit of the parent company as £715,420 (£629,462).

Electrical Components, Ltd., which paid no dividend for 1945-46, has announced an interim dividend of 7½ per cent on account of the year ending June 30th, 1947.

The General Cable Manufacturing Co., Ltd., is paying a final dividend of 17 per cent (against 9 per cent), making a total distribution for the year of 25 per cent (against 15 per cent).

The Metropolitan Electric Cable & Construction Co., Ltd., is again paying an interim dividend of 5 per cent.

The Victoria Falls & Transvaal Power Co., Ltd., has declared an interim dividend of 4½ per cent (against 4 per cent).

The Lisbon Electric Tramways, Ltd., is maintaining its interim dividend at 2½ per cent, tax free.

Joseph Lucas, Ltd., report a profit of £312,727 for the past year (against £319,270 for 1944-45). The ordinary dividend is maintained at 15 per cent.

Lewis Berger & Sons, Ltd., out of a net profit of £296,856 (against £202,146) are paying a final ordinary dividend of 18 per cent, making 26 per cent (against 19 per cent) for the year.

New Companies

Electrical Accessories (Lancaster), Ltd.—Registered November 19th. Capital, £4,000. To acquire the business of a wholesale dealer in electrical and motor accessories carried on by John Bury at King's Arms Yard, King Street, Lancaster, as "Electrical Accessories." Permanent directors: J. Bury and E. L. Keates. Regd. office: King's Arms Yard, King Street, Lancaster.

S. Hancock, Ltd.—Registered November 16th. Capital, £3,000. Electrical engineers, electrical installation contractors and electrical plant maintenance engineers, etc. Directors: L. H. Mackerness and C. N. Fallas. Regd. office: Brownsfield Mill, Great Ancoats Street, Manchester.

Newton Electric (Birmingham), Ltd.—Registered November 20th. Capital, £1,000. Electrical engineers and general electrical installation contractors, lighting specialists, etc. Directors: F. Graham and J. B. Newton. Regd. office: 99a, Eachelhurst Road, Erdington, Birmingham.

Eric Staines (Electricals), Ltd.—Registered November 20th. Capital, £500. Electricians, electrical, radio and television engineers, etc. E. W. Staines is the first director. Secretary: B. J. Andrews. Regd. office: Ingleside, Lympne, Hythe, Kent.

Apex Productions, Ltd.—Registered November 6th. Capital, £3,000. Manufacturers of, and dealers in, electrical and mechanical products, etc. Permanent directors: W. L. Johnson, R. A. Penny, N. G. Sleeman and W. H. A. Chancellor. Solicitors: Herbert Baron & Co., E.C.4.

A. Pocock (Bath), Ltd.—Registered November 7th. Capital, £100. To acquire the business of an electrical and radio engineer carried on by A. E. Pocock at Craven, Upper Wellsway, Odd Down, Somerset. Directors: A. E. Pocock and C. A. Ratcliffe. Regd. office: 2, Burnt House Cottages, Odd Down, Bath.

Counties Relay, Ltd.—Registered in Edinburgh November 5th. Capital, £30,000. To adopt an agreement between Galashiels Relay, Ltd., Selkirk Relay, Ltd., and Peebles Relay, Ltd., and to establish and carry on wireless relay systems. Directors: The Earl of Lauderdale, B. Groom and J. Smith. Regd. office: 40, Island Street, Galashiels.

Swanavon, Ltd.—Registered November 19th. Capital, £100. Manufacturers of, and dealers in, electrical fittings, appliances and components, particularly in relation to stage lighting of a special character, etc. Subscribers: J. D. Brown, 124, Chancery Lane, W.C.2, and R. H. Herbert, Greenacre, Hill Road, Theydon Bois. Secretary: R. H. Herbert.

Sandford, Daley & Co., Ltd.—Registered November 19th. Capital, £1,000. Manufacturers and repairers of, and dealers in, dynamos, motors, armatures, magnetos, etc. First directors: B. J. Daley, R. G. Sandford and H. D. Daley. Regd. offices: 50, St. Aubyn Street, Devonport, Plymouth.

Increases of Capital

"Solus" Electrical Co., Ltd.—Increased by £57,000 beyond the registered capital of £25,000. (5,680 of the new ordinary shares are created for the purpose of acquiring shares in Schall & Sons, Ltd.)

Wayne Kerr Laboratories, Ltd.—Increased by £5,050, in 5,000 preferred ordinary shares of £1 and 1,000 deferred ordinary shares of 1s., beyond the registered capital of £10,100.

Broadcast Relay Service, Ltd.—Increased by £700,000 beyond the registered capital of £1,200,000.

Yorkshire Electric Transformer Co., Ltd.—Increased by £25,000 beyond the registered capital of £15,000.

C.J.R. Electrical & Electronic Development, Ltd.—Increased by £2,000 beyond the registered capital of £500.

Franklin Electric Co., Ltd.—Increased by £14,500 beyond the registered capital of £500.

Q Vehicle Co., Ltd.—Increased by £59,900 beyond the registered capital of £100.

London Signs & Illuminations, Ltd.—Increased by £9,900 beyond the registered capital of £100.

Vacuums, Ltd.—Increased by £5,000 beyond the registered capital of £5,000.

Bankruptcies

A. E. Starr, 11, Cross Mount Street, Batley, Yorks, lately carrying on business under the style of Electronic Enterprises, 125, Commercial Street, Batley, and formerly at 2, Brewery Lane, Thornhill Lees, Dewsbury, electrical and radio engineer.—The public examination of this debtor was held recently at the County Court, Eightlands, Dewsbury, when it was reported that the liabilities amounted to £250 and there was a deficiency of £165. The examination was closed.

W. H. Grange, electrical engineer, carrying on business as the Talbot Electrical Co., at 14, Plumstead Road, Thorpe Saint Andrew, Norfolk.—Last day for receiving proofs for dividend December 20th. Trustee, Mr. F. R. D. Walter, Castle Chambers, Opie Street, Norwich.

Liquidations

Holborn Construction Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. N. Gammidge, Spencer House, South Place, London, E.C.2.

STOCKS AND SHARES

THE course of Stock Exchange prices continues to be determined largely by the need for finding investments with which to replace the Local Loans stock to be paid off early in the New Year. Other substantial amounts fall due for repayment within the next six months, and there is a daily scramble for alternative stocks and shares upon which a reasonable rate of return can be obtained. Government pronouncements dwell ceaselessly upon the intention to maintain cheap money. Good dividends are the order of the day in the industrial market. These also serve to accentuate demand from investors.

Home Rails

In principle and detail the Transport Bill is being hotly attacked, but after an interval for digestion of the details, prices in the market concerned have mostly maintained the recovery which followed its first appearance. As then, a chief support for quotations is the consideration that the senior stocks, at least, can expect two further interest payments before they are exchanged in January, 1948, for the Government compensation stock. Despite the recovery, most quotations are still appreciably below those fixed by the Government for compensation purposes. This attracts institutional buyers on the view that they are, in effect, acquiring Government stock at a discount. No indication has yet been given as to the nature of the compensation stock.

Home Electricity Supply

The cut in the use of coal which has been called for by the Minister of Fuel and Power, has had a slightly depressing effect upon the prices of shares in the Home electricity supply companies. At present the supplies of coal to electricity undertakings are not affected, though industrial and commercial consumers are to be restricted by 2½ per cent In the Stock Exchange market, the opinion is that in view of the enormous amount of power which the companies are supplying, the intended cut to certain users will make little material difference to profits and dividends. Falls of 6d. to 1s. have occurred in the ordinary shares of some ten companies.

Joint Enterprises

Crompton Parkinson shares are a trifle lower at 33s. 6d., in spite of the declaration of dividend and bonus again making a total of 22½ per cent for the year. Allowing for the final distribution in the price, the return works out to nearly 3½ per cent. Austin Motors are on the dull side at 40s., although considerable interest was aroused by the report of an agreement with Cromptons for the joint production of electric vehicles. Tube Investments, now 6¾, have been a firm market since the appearance of the impressive annual report and full accounts. This company is also to engage in a joint enterprise, the other participants being British Aluminium and Hawker Siddeley, the object being the manufacture of aluminium wire and cable.

Miscellaneous Changes

General Cable shares responded, with a rise of 1s. 6d. to 25s. 6d., to the increase in the dividend from 15 to 25 per cent. Electrical equipment shares as a whole have shown strength during the week. Associated Electrical Industries at 74s. 6d., Ever Ready at 50s. and Ericssons at 56s. 3d., are all half-a-crown to the good. Gains of 1s. are shown by Johnson & Phillips at 83s. 6d., and Walsall Conduits at 58s. General Electrics at 104s. 6d. have put on 1s. 6d., Mather & Platt are 2s. 3d. better at 57s. 3d., and a number of others show small improvements.

In the radio group, Cossors at 31s. 6d. are better on the week, but Radio Television and Scophony have lost ground to 11s. and 8s. 6d. respectively. Among traction shares, B.E.T. deferred, after fluctuations, finished 45 points down at 1,230. Cable & Wireless preference lost 4 points, receding to 119, and the ordinary is easier at 118. Great Northerns are up from 35 to 37.

New Issues

Dealings began last week in Dictograph Telephones new 5½ per cent preference shares at 25s. They afford at this price the relatively generous yield of £4 8s. per cent. Holders of the company's ordinary shares had the right to take up the shares at par, in the proportion of one for every twenty shares held. The ordinary at 5s. 3d. are a shade better.

Thomas Tilling

The price of Thomas Tilling shares has been moving erratically since the railway nationalization terms were published. From 57s. 6d. the price was run up to 64s. 6d., from which it reacted to 60s. The company has been paying 10 per cent on its ordinary stock, and the yield is now £3 6s. 8d. per cent on the money. The Thomas Tilling assets consist mainly of interests in a number of motor services, and £1,207,000 London Passenger Transport "C" stock. Calculation of the value of Tilling shares, worked out on a 4½ per cent basis of yield from the investments, brings out Tillings to 60s. 6d. per share, while on a 4 per cent basis it would be 68s. From both amounts, 2s. per share must be deducted as the value of the company's preference capital on a 4 per cent basis. In addition, however, the company owns a general motor business, freehold and leasehold properties and investments worth £1,350,000 at par. It is impossible to say with exactitude what the break-up value of Tillings is. At anything like 60s. the shares may be regarded as a sound investment.

Contractors' Hired Equipment

Liability of Employer for Employee's Acts

By F. E. Sugden,
A.C.I.S., Barrister-at-Law

IT is common practice for contractors to hire plant, equipment and vehicles because of the excessive cost of equipment used only on occasions and also because of the difficulty of obtaining skilled men to operate the equipment if it is purchased.

When accidents happen in connection with these appliances the question of the legal position of the hirer arises where the operator meets with an accident or is the cause of an accident. A case recently before the House of Lords is of interest on this account.

Briefly the facts of this case were that a firm of stevedores had hired from a contractor the use of a crane together with its driver to assist in loading a ship lying in dock. The contractor was subject to the Hiring Contractors' Regulations which contained the clause: "The driver so provided shall be the servant of the applicants." The driver in question was a skilled workman engaged and paid by the hiring contractor and the contractor alone had power to dismiss him. The stevedores directed what operations should be executed by him, but they had no authority to direct how he should work the crane.

Owing to the driver's negligence, a checker employed by the forwarding agents who had engaged the stevedores was injured in the course of his employment. The question to be determined was, whether, in applying the liability maxim (that is, certain rules and laws are laid down whereby Common Law explains what must operate to make a person liable for damages and for injuries) the employers of the crane driver or the hirers of the crane were liable for the driver's negligence.

It was contended by the owners of the crane that under the terms of the contract between them and the stevedores, the stevedores were liable. The House of Lords held that the question of liability was not to be determined by an agreement between the general employers and the hirers, but depended on the circumstances of the case, the proper test to apply being whether or not the hirers had authority to control the manner of the execution of the relevant acts of the driver.

The crane owners, as general employers of the crane driver, had failed to discharge the burden of proving that the hirers had such control of the workman at the time of the accident as to become liable as employers for his negligence, since although the hirers could tell the crane driver where to go and what to carry, they had no authority to give directions as to the manner in which the crane was to be operated. The crane owners were, therefore, liable for his negligence.

This case is important because, speaking from a professional angle, there has always been great difficulty in finding the dividing line between the responsibility of the hirer of the workman with his equipment and that of the owner of the equipment who actually employs the workman. It also underlines the point that the actual conduct of the parties to the agreement should be specifically stated.

It is not always possible to include all the conditions of hire in an agreement; they may be contained in letters between the parties. The agreement, moreover, may be a verbal one, but in any case the points of law involved are the same. The House of Lords' decision lays down that in all future cases, irrespective of the trade, where a crane is hired with its driver, who is deemed to be skilled, all that concerns the hirer is that the work is carried out on his behalf and not the method of carrying it out.

Suppose the hirer or his employees or other servants request the employee or other servants of the owner of the crane to lift certain machinery from one place to another. It might be necessary to sling it, and use all kinds of tackle for the purpose. If the hirer contents himself with giving the removal instruction, well and good, he can never be held liable for the accident caused to the hired workman, or caused by the hired workman. But if by arrangement he employs the driver through the owner of the crane and he tells the crane driver, alsó by arrangement with the owner, how the goods should be lifted, how the crane should be operated as distinct from directing the actual lifting of the goods concerned, then the hirer will be held liable.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *may be obtained from the Patent Office*, 25, *Southampton Buildings, London, W.C.*2.

ARROW Electric Switches, Ltd.—" Indexing means for multi-position rotary electric switches." 16660/44. September 1st, 1943. (582687.)

N. C. Barford.—" Tuning mechanism for hollow electrical resonators." 13463. July 13th, 1944. (582603.)

K. Baumann and Metropolitan-Vickers Electrical Co., Ltd.—" Power plant comprising elastic fluid turbines driving load shafts through speed reduction transmission gearing." 5796. April 29th, 1942. (582620.) " Power plant including elastic fluid turbines driving load shafts through transmission gearing." 16343. November 18th, 1942. (582622.)

E. G. Bowen, D. Taylor and K. G. Budden.—" Radio locating apparatus." 18362. December 25th, 1942. (582494.)

B. P. L. (Instruments), Ltd., and B. Digby.—" Valve voltmeter." 8314. May 3rd, 1944. (582544.)

British Insulated Cables, Ltd., and B. S. Robson.—" Variable ratio gearing." 5504. March 24th, 1944. (582516.)

British Thomson-Houston Co., Ltd.—" Electric lamp signalling units." 8703/44. May 11th, (582547.) " Electric meters of the induction type." 11089/44. June 11th, 1943. (582561.)

British Thomson-Houston Co., Ltd., and A. Bowen.—" Means for breaking up air flow over streamline bodies." 12932. July 6th, 1944. (582598.)

British Thomson-Houston Co., Ltd., and C. J. Milner.—" Resonators used with electron discharge devices of the velocity modulated type." 13950. October 29th, 1941. (582484.) " Electron discharge devices of the velocity modulation type employing resonating chambers." 1775. February 10th, 1942. (582491.)

British Thomson-Houston Co., Ltd., and W. J. Scott.—" Electron discharge devices of the velocity modulation type employing resonating chambers." 16530. December 22nd, 1941. (582487.) " Electron discharge devices of the velocity modulation type employing resonating chambers." 16531. December 22nd, 1941. (582488.) " Resonating chambers employable in electron discharge devices of the velocity modulated type." 1503. February 4th, 1942. (582490.)

British Thomson-Houston Co., Ltd., T. H. Kinman and L. J. Davies.—" Electron discharge devices of the velocity modulation type employing resonating chambers." 15796. December 8th, 1941. (582486.)

L. F. Broadway and C. S. Bull.—" Electron discharge devices employing velocity modulation or employing hollow resonators." 6528. May 21st, 1941. (582616.)

E. P. Brus.—" Renewable electric fuse plug." 12653. July 3rd, 1944. (582594.)

Calor Soc. Anon. pour la Fabrication des Appareils de Chauffage et des Appareils a Usages Domestiques par l'Electricité.—" Removable connection boxes for electric cooking apparatus." 17191/39. July 5th, 1938. (582661.)

H. Candeland and Z. K. Hass.—" Electrical signalling systems." 21567. December 23rd, 1943. (582632.)

H. Cassman.—" Electron discharge devices having screens required to be present in the envelope during treatment with gas or vapour noxious to the screens." 11694. September 12th, 1941. (582483.)

Chloride Electrical Storage Co., Ltd. (C. D. Galloway).—" Electric accumulators." 25922. December 27th, 1944. (582654.)

Cinch Manufacturing Corporation.—" Electrical connector clips." 16144/44. August 31st, 1943. (582677.)

J. D. Cockcroft, J. Ashmead, W. S. Eastwood, A. J. H. Oxford and W. A. S. Butement.—" Radio installations for locating distant bodies." 16742/44. December 4th, 1942. (Divided out of 582493.) (582521.) " Radio installations for locating distant bodies." 17309. December 4th, 1942. (582493.)

A. C. Cossor, Ltd., and J. M. S. Speirs.—" Magnetron electric discharge devices." 16828. December 31st, 1941. (582489.)

Creed & Co., Ltd., and R. D. Salmon.—" Alarm devices for indicating failure of the paper feed mechanism in teleprinters." 5506. March 24th, 1944. (582528.)

Creed & Co., Ltd., and A. E. Thompson.—" Teleprinters." 6245. April 4th, 1944. (582531.)

Creed & Co., Ltd., A. E. Thompson and R. D. Salmon.—" Teleprinters." 6557. April 7th, 1944. (582532.)

A. G. Crossland.—" Fluorescent electric lighting fittings." 15615. August 16th, 1944. (582671.)

Dubilier Condenser Co. (1925), Ltd., and C. H. Munday.—" Sealing arrangements for electrical condensers or other electrical devices." 15352. August 11th, 1944. (582669.)

Enfield Zinc Products, Ltd., and J. Grimston.—" Manufacture of seamless zinc cans for dry batteries." 10275. May 26th, 1944. (582554.)

English Electric Co., Ltd., and F. G. Rowland.—" Electric gas blast circuit-breakers." 12987. July 7th, 1944. (582599.)

General Electric Co., Ltd., and W. G. Thompson.—" Braking of direct-current motors." 11962. June 23rd, 1944. (582588.)

General Electric Co., Ltd., J. N. Bowtell, R. L. Breadner, and E. E. Miles.—" Seals incorporating vitreous materials." 11635. June 19th, 1944. (582566.)

General Electric Co., Ltd., H. C. Turner and T. R. Rudge.—" Apparatus for indicating the speed of rotary machines." 17687. September 15th, 1944. (582694.)

India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., and H. L. Harding.—" Storage battery or like containers." 13156. August 13th, 1943. (582499.)

A. W. G. Kingsbury and H. E. R. Kingsbury. —" Means for unwrapping tape, cotton, wire or the like from a cable." Cognate applications 9962/44 and 15170/44. May 23rd, 1944. (582583.)

Mallory Metallurgical Products, Ltd.—" Electric contacts." 10976/44. June 8th, 1943. (582558.)

Marconi's Wireless Telegraph Co., Ltd.— " Automatic tuning of radio transmitters." 10668/44. March 29th, 1943. (582585.)

Marconi's Wireless Telegraph Co., Ltd., L. C. Styles and V. D. Brooker.—" Telegraph transmitters." 16312. August 28th, 1944. (582679.)

S. Marks and E. R. Booth.—" Rotary electric switches." 17755. September 16th, 1944. (582696.)

F. G. Mitchell.—" Cooling towers." 19274/43. November 20th, 1944. (582630.)

Okonite-Callender Cable Co., Inc.—" Method of, and apparatus for, the manufacture of electric power cables." 14222/44. August 3rd, 1943. (582613.)

Oldham & Son, Ltd., and H. Akroyd.— " Electromagnetic relays." 4361. April 21st, 1944. (582536.)

A. F. Pearce.—" Hollow electrical resonators." 9483. June 11th, 1943. (582626.)

A. F. Pearce, and N. C. Barford.—" High-frequency electrical devices having gas-tight envelopes." 9482. June 11th, 1943. (582625.)

W. S. Percival.—" Circuit arrangements using electron discharge devices employing hollow resonators." 9475. July 25th, 1941. (582617.)

Philips Lamp, Ltd.—" Electric transformers." 13653/44. May 5th, 1943. (582607.)

A. Reyrolle & Co., Ltd., A. Allan and R. Shannon.—" Gas-operated electric switchgear." 22462. November 14th, 1944. (582701.) " Gas-operated electric switchgear." 23214. November 22nd, 1944. (582702.)

A. Reyrolle & Co., Ltd., A. Allan and J. F. S. Small.—" Spring driven operating-mechanism for electric switchgear." 14568. July 31st, 1944. (582643.)

G. R. Shepherd (Westinghouse Electric International Co.).—" Speed control systems for alternating-current motors." 3251. February 22nd, 1944. (582510.)

Sperry Gyroscope Co., Inc.—" Apparatus for comparing the phase or time delay between two waves, and to distance measuring devices." 16273/42. February 25th, 1942. (582492.)

" Ultra high-frequency electron discharge devices." 987/44. January 22nd, 1943. (582526.)

Standard Telephones & Cables, Ltd.— " Filamentary heating elements for electric discharge tubes and other purposes." 3113/44. February 20th, 1943. (582664.)

Standard Telephones & Cables, Ltd. (International Standard Electric Corporation).— " Velocity modulated electron discharge devices." 15345. November 28th, 1941. (582485.)

Standard Telephones & Cables, Ltd., and D. L. A. Driver.—" Manufacture of selenium products." 8525. May 5th, 1944. (582546.)

Standard Telephones & Cables, Ltd., and C. H. Foulkes.—" Resonator structures for electron discharge devices." 2023. February 14th, 1941. (582615.)

Standard Telephones & Cables, Ltd., and E. M. S. McWhirter.—" Vibrator relays." 16406. August 29th, 1944. (582683.)

Standard Telephones & Cables, Ltd., and A. J. Maddock.—" Thermionic valves." 9519. July 26th, 1941. (582618.)

Svenska Turbinfabriks Aktiebolaget Ljungstrom.—" Blade rings for radial flow elastic fluid turbines." 1102/44. July 1st, 1943. (582563.)

Telegraph Condenser Co., Ltd., and P. A. Sporing.—" Electrical condenser." 15043. August 8th, 1944. (582651.)

G. W. Walton.—" Detention of objects by means of ultra-short electromagnetic waves." 11648. September 11th, 1941. (582482.)

Ward & Goldstone, Ltd., and W. H. Willett.— " Electric switches." 14734. August 2nd, 1944. (582645.) " Electric plug-and-socket connectors." 14735. August 2nd, 1944. (582646.)

Westinghouse Electric International Co.— " Refrigeration apparatus." 13484/44. September 27th, 1943. (582604.)

H. D. Wheeler and P. A. H. Mossay.— " Control of acceleration and reversal of electric motors in Ward-Leonard equipment." 357. January 7th, 1944. (582573.)

F. C. Williams and E. L. C. White and D. Blumlein (legal representative of A. D. Blumlein).—" Pulse signal selecting and indicating systems." 17006. October 15th, 1943. (582503.)

The Blind in Industry

THE problem of the drop in the number of blind employed in industry is dealt with in the annual report of the National Institute for the Blind. The Institute has augmented its Placement Section by a number of partially blind men acquainted with the technique both of blindness and industrial employment. A body of experts is also continuously finding more processes suitable for sightless workers, the number of such processes already found exceeding five hundred. One man, totally blind and deformed in both hands, is now skilled in assembling electric motors, and a war-blinded stage dancer is assembling electric fires.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Essex.—December 20th. Education Committee. Electrical installations in new schools at Chingford and Chigwell. Particulars from H. Conolly, county architect, County Hall, Chelmsford. (From the names submitted, a panel of contractors will be chosen, who will subsequently be provided with specifications.)

Exeter.—December 30th. Electricity Department. Two 12,000-kVA transformers. (December 6th.)

Forres.—December 23rd. Town Council. Electrical work in connection with 32 houses at Fleurs Place No. 3 site (deposit, £3 3s.).—Rowand, Anderson and Paul & Partners, 107, High Street, Forres.

Hastings.—January 13th. Electricity Department. Two 2,000-kVA Scott-connected transformers and two switch kiosks. (December 6th.)

Isle of Ely.—January 4th. County Council. Installation of electric lighting at the Orchards Nursery, Wisbech.—R. D. Robson, county architect, County Hall, March.

London.—Metropolitan Water Board. New or second-hand alternators, three-phase, 400/440-V, for coupling to Diesel engines running at 600 r.p.m. (eighteen approximately 200 kW and six approximately 300 kW). (See this issue.)

Manchester.—January 13th. Electricity Committee. 6·6-kV substation switchgear. (December 6th.)

Newark-on-Trent.—January 16th. Borough Council. P.i. and armoured cable. (See this issue.)

Newport (Mon.).—December 31st. Corporation. Electrical installations in 134 houses, Alway Farm estate. (December 6th.)

North Scotland.—January 20th. Hydro-Electric Board. High- and low-voltage distribution lines (wood poles) on the island of Arran. (See this issue.)

Rhondda.—December 28th. Urban District Council. Six 300-kVA three-phase oil-immersed static transformers, 11,000/415/240 V. (See this issue.)

Romford.—December 23rd. Town Council. Electrical installations in 144 houses on Gobions estate. Borough surveyor.

St. Faith's and Aylsham.—December 28th. Rural District Council. Electrically operated pumping and pressure distribution plant for seven sites. W. Herbert Bateman & Partners, Halifax House, Bank Plain, Norwich.

Orders Placed

Birmingham.—Electricity Committee. Accepted during the last three months. Battery together with rectifier at Prince's electricity station, Nechells.—Tudor Accumulator Co. Oil circuit breakers.—Mudie's Electrical Co. Meters.—British Electric Meters; Smith Meters; Ferranti; Measurement; Chamberlain & Hookham. Transformers.—Ferranti; British Thomson-Houston Co.; British Electric Transformer Co. Extensions to automatic telephone exchange at Hams Hall "B" power station.—Standard Telephones & Cables. Superheater elements at Prince's station, Nechells.—Simon-Carves. Medium and low voltage rubber insulated cables for one year ending June 30th, 1947.—Mersey Cable Works.

Huddersfield.—Corporation. Accepted. Two 300-kVA and one 750-kVA transformers.—Met.-Vick. Electrical Co.

London.—L.C.C. Accepted. Wiring and fittings for electric lighting, etc., in blocks of dwellings on the Tulse Hill Estate, Lambeth.—Ayr Engineering & Constructional Co.

Rochdale.—Electricity Committee. Accepted. Meters for twelve months.—Met.-Vick. Electrical Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ampthill.—Houses (49), and 12 flats; U.D.C. surveyor, Ampthill, Beds.

Barnes.—Maisonettes (81), Lonsdale Road (£102,029); A. J. Riggs, Ltd., builders, 12, Seaforth Avenue, New Malden, Surrey.

Birmingham.—Houses (100), Coventry Road and Sandy Lane junction; city engineer. Technical college (£2,028,000); city architect. Offices and factory buildings, Lime Kiln Lane; Flexible Shaft & Cover Manufacturing Co., Ltd. Engineering works, Central depot site (£50,000).—Thomas W. Ward, Ltd.

Blackburn.—Multiple chain stores, Church Street and Victoria Street; Littlewoods Mail Order Stores, Ltd., 100, Old Hall Street.

Brierley Hill.—Houses (58), Tack Farm estate; J. R. Moore, architect, U.D.C. Offices, Moor Street.

Bridge of Allan.—Houses (64), near Westerton Drive; burgh engineer.

Bromsgrove.—Houses (24), Redditch Road; J. E. Tolladay, West Heath.

Chadderton.—Houses (70), Melbourne Street, for U.D.C.; F. W. Pexton, architect, Town Hall.

Coventry.—Houses (416), West estate (£454,272); city engineer.

Daventry.—Houses (318) on 21 sites; R.D.C. surveyor.

Durham.—Mining college in North-East Durham; county architect, 34, Old Elvet.

Edmonton.—Houses (200), near Enfield boundary at Cheshunt; borough engineer, Town Hall.

Gateshead-on-Tyne.—Factory at the North Eastern Trading estate; Hetherington & Wilson, County Chambers, Westgate Road, Newcastle.

Glasgow.—Swedish timber houses (200) at Robroyston & Balorcock (£245,559) and 2,142 houses at Priesthill (£2,606,300); housing director.

Great Yarmouth.—Permanent houses (55), development scheme No. 2, Gorleston; H. F. Dyson, borough engineer, Town Hall.

Hampstead.—Housing scheme, King Henry's Road; D. & D. J. Wood, architects, 1, Old Burlington Street, London, W.1.

Hartlepool.—Block of flats for the Sutton Dwelling Trust; C. S. Errington, architect, 46, Grainger Street, Newcastle-on-Tyne.

Haverfordwest.—Permanent houses (128), on several sites, for R.D.C.; A. J. Davies, surveyor, Council Offices, 10, Picton Place.

Hull.—New factory at Stoneferry for J. L. Spooner, Ltd., Durham Street.

Hyde.—Bungalows (25) and 305 houses, Harbour Farm estate; T. Cooper, borough surveyor.

Ilkeston.—Houses (133), Cotmanhay estate; A. Mason (Contractors), Ltd., Sutton Road, Mansfield, Notts.

Lanchester (Co Durham).—Houses (415) for R.D.C.; surveyor, R.D.C. Offices.

Liverpool.—Flats (60), in five blocks, Cantril Farm estate, West Derby; director of housing, Blackburn Chambers, Dale Street, Kingsway, Liverpool, 2.

Longbenton (Northumberland).—Electric lighting and equipment in 156 houses for U.D.C.; surveyor, U.D.C. Offices, Forest Hall.

Malden and Coombe.—Houses (42), Elm Road, New Malden; H. E. Barrett, town clerk, Municipal Offices.

Manchester.—Primary schools at Booth Hall estate and Blackley; L. C. Howitt, city architect, Town Hall.

Houses (1,067), Newall Green (£1,302,064); hostel at Crumpsall Hospital (£52,200) and boiler house, Withington Hospital (£60,000); city engineer.

Market Harborough.—Houses (82), on eleven sites; R.D.C. surveyor, Council Offices, Exchange Buildings.

Middlesbrough.—Extensions to factory for J. B. Corrie & Co., Ltd., Gray Street.

Newbury.—Houses (92), Shaw estate; borough engineer.

Newcastle-on-Tyne.—Printing works, Meldon Street, for J. W. Hindson & Sons; Hetherington & Wilson, County Chambers, Westgate Road.

New Romney.—Houses (50) (costing £66,022); E. W. Sanders (London), Ltd., builders, 49, Newington Causeway, London, S.E.1.

Northampton.—Factory, Industrial estate; B. B. Vos & Sons, Ltd., Campbell Square.

Northwich.—Permanent houses (140), in ten parishes; J. Birtwistle, R.D.C. surveyor, Whitehall, Hartford.

Norwich.—Extensions to factory for J. Mackintosh & Sons, Ltd., Chapel Field.

Oughtibridge.—Extensions to steel works, for cold strip roll and road vehicle springs; Samuel Fox & Co., Ltd., Stocksbridge.

Paisley.—Factory (£76,520); J. Anderson & Co. (Colours), Ltd., 61, Florence Street, Glasgow.

Peterhead.—Proposed water scheme to cost £13,340 (pump house, etc.); J. and A. Leslie & Reid, civil engineers, Edinburgh.

Permanent houses (72), Clerkhill Road; burgh surveyor.

Ripponden.—Houses (102), on three sites; Glendinning & Hanson, architects, Albany Chambers, Commercial Street, Halifax.

Rugeley.—Factory adjoining gas works; E. Pinchess & Co., Ltd., boot manufacturers, Rossendale Road, Earl Shilton, near Hinckley.

Rushden.—Factory for Sound Engineering Co., Hove Road.

Seaham.—Houses (500), on new estate west of Stockton Road; A. M. Smith, U.D.C. surveyor.

Silloth (Cumberland).—Factory for S. Redmayne and Co., Ltd.; West Cumberland Industrial Development Co., Ltd., Roper Street, Whitehaven.

Stockton.—Extensions to works for E. Hullah & Co., Gray Street.

Thanet.—Technical school for girls (£15,000); Kent county architect, Maidstone.

Walsall.—Extension to factory; Anderson & Homer, Frederick Street.

Wembley.—Permanent houses (164), Fryent estate, N.W.9; borough engineer, Town Hall.

West Riding.—Secondary school at Ecclesfield (£112,564); county architect, County Hall, Wakefield.

Wishaw.—Canteen for Coltness Iron Co., Ltd. (£2,000); manager.

Wokingham.—Permanent houses (38), London Road; E. G. V. Hives, Council's architect, 3, Cork Street, Reading.